Attorney's Docket No. 351606.00500

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

In the application of: Mitchell et al. Serial No.: 10/721,583 Filed: Nov. 24, 2003 For: Method and Apparatus for Harvesting, Washing and Drying Cut Vegetables and Produce	Examiner: THAKUR, Viren A. Group Art Unit: 1794 **APPELLANT'S BRIEF**

APPEAL BRIEF

Board of Patent Appeals and Interferences
Mail Stop Appeal Brief Patents
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

This is an appeal from the Final Office Action dated November 12, 2009, finally rejecting Claims 1, 2, 4 – 10, 12, 15, 19, 22, 24, 33 – 41 and 66 - 72.

Real Parties in Interest

The assignee Misionero Vegetables is the real parties in interest.[1]

[1] By corrective assignment, filed April 12, 2010

Related Appeals and Interferences

There are no related appeals or interferences known to Appellants or the Appellant's legal representative, which will directly affect or be directly affected by or have a bearing on the Board's decision on this appeal.

Status of the Claims

Claims 1, 2, 4 – 10, 12, 15, 19, 22, 24, 33 – 41 and 66 - 72 are pending and were finally rejected. Claims 3, 11, 13, 14, 16 -18, 20, 21, 23, 25 – 32, and 42 - 65 have been cancelled.

Claim 10 was objected to under 35 U.S.C. 112 for the term "transport vehicle."

Claims 1, 2, 4, 5, 7, 19, 22, and 66 – 69 were rejected under 35 U.S.C 103(a) as being unpatentable over Brown (US 2003/0126850 A1) in view of Brown, et al (US 6298865), Garcia, Jr., et al (US 6626192) Tarantino, et al (US 2004/0187465 A1), Mitchell, et al (US 6112429), Cress, et al (US 6223502) and Levy, et al (US 5566695).

Claim 6 was rejected under 35 U.S.C. 103(a) as being unpatentable over the references as applied to Claim 1, in further view of Hererra (US 2003/0217650). Claims 8 – 10, 12 and 15 were rejected under 35 U.S.C. 103(a) as being unpatentable over the references as applied to Claim 1 above, in further view of Hougham (US 5316778), Busta (US 3814820), Crossett (US 2666711), Bell et al. (US 1708253) and Alameda (US 5130152).

Claim 24 was rejected in further view of Terry (US 5711980). Claims 33 – 36, 40 – 41, and 70 – 72 were rejected in further view of Hougham. Claim 37 was rejected under 35 U.S.C 103(a) in further view of Fox et al. (US 2644473). Claims 38 – 39 were rejected under 35 U.S.C 103(a) as being unpatentable over the references applied to Claims 33 – 36, 40 – 41, 70 – 72, and in further view of Hougham, Busta, Crossett, Bell et al. and Alameda.

In addition, Claims 1, 2, 4, 5, 7 – 10, 12, 15, 19, 22, 33 – 41 and 66 – 72 were rejected under 35 U.S.C. 103(a) as being unpatentable over Mitchell et al. in view of Hougham, and in further view of Brown, Brown et al, Garcia Jr. et al. and Tarantino et al. Cress et al. and Levey et al. have been relied on as evidence. Claim 6 was rejected under

35 U.S.C. 103(a) over these references, and in further view of Hererra. Claim 24 was rejected under 35 U.S.C. 103(a) over these references, and in further view of Terry.

The rejection of Claims 1, 2, 4 – 10, 12, 15, 19, 22, 24, 33 – 41 and 66 - 72 is the subject of this Appeal.

Status of Amendments

No amendments after the final rejection have been filed or entered.

Summary of Claimed Subject Matter

As disclosed in the Figures and described in the specification, the present claims are generally directed to methods for harvesting, washing, and drying cut vegetables and produce. Various additional features are claimed as set forth in the claims below.

In more specific detail, the independent claims map to the specification and drawings as follows:

1. A method, comprising the steps of:

cutting a product from a stalk from which it was grown; **[pg. 7:1 – 5; pg. 11:3 – 4; pg. 15:12; Figs. 1, 3]**

removing a core of the product to form a de-cored product; **[pg. 7:1 – 5; pg. 11: 6 – 14; pg. 15:12; Figs. 1, 3]**

placing the de-cored product in a tote, wherein the step of placing comprises placing a plurality of de-cored products in a first row of the tote with de-cored ends of the products in the first row facing a first side of the tote; **[pg. 7: 1 – 5; pg. 11: 18 – 23; pg. 17:18 – pg. 18:3; Figs. 1, 2, 3, 4]**

cleaning the de-cored products in the tote by immersing the tote in a wash tank for cleaning, wherein the wash tank comprises a flow of washing fluid in a direction toward the de-cored ends of the products, such that the first side of the tote faces the direction of flow of washing fluid, whereby the flow of washing fluid flows through the de-cored end of each product to an opposite end of each product. **[pg. 7:6 – 23; pg. 13: 6 – 19; pg. 18:7 – 20; Figs. 1, 2, 3, 4, 6]**

33. A method, comprising the steps of:

cutting a product from a stalk from which it was grown; **[pg. 7:1 – 5; pg. 11:3 – 4; pg. 15:12; Figs. 1, 3]**

removing a core from a core end of the product, forming a de-cored product; **[pg. 7:1 – 5; pg. 11: 6 – 14; pg. 15:12; Figs. 1, 3]**

pre-washing the de-cored end of the product; **[pg. 7:8 -9; pg. 16:12 – 22; Fig. 3]**

loading the de-cored product in a tote in a pre-aligned direction relative to the tote, wherein a de-cored end of each of a plurality of products is placed against a side of the tote, and the tote includes openings large enough to allow the flow of a washing fluid through the tote and small enough to secure each product in the tote; **[pg. 7: 1 – 5; pg. 11: 18 – 23; pg. 17:18 – pg. 18:3; Figs. 1, 2, 3, 4]**

transporting the tote to a processing facility; **[pg. 17:6 – 17; Fig. 3]**

immersing the tote in a washing tank having washing fluid; **[pg. 7:6 – 23; pg. 13: 6 – 19; pg. 18:7 – 20; Figs. 1, 2, 3, 4, 6]**

conveying the tote through the washing fluid with the de-cored ends of each product facing a direction of conveyance, the speed of conveyance sufficient to cause at least some of the washing fluid to flow through the de-cored end and out a leafy end of each product; **[pg. 7:6 – 23; pg. 13: 6 – 19; pg. 18:7 – 20; Figs. 1, 2, 3, 4, 6]**

loading the tote, directly from the washing tank, without re-loading, to a spin dryer; and **[pg. 24:2 – 5; Fig. 8]**

drying each washed de-cored product in the tote in the spin dryer. **[pg. 15:14 – 17; pg. 24:2 – 5; Fig. 8]**

69. A method of processing produce, comprising:

cutting a product from a stalk from which it was grown; **[pg. 7:1 – 5; pg. 11:3 – 4; pg. 15:12; Figs. 1, 3]**

removing a core of the product to form a de-cored product; **[pg. 7:1 – 5; pg. 11: 6 – 14; pg. 15:12; Figs. 1, 3]**

placing the de-cored product in a tote, wherein the step of placing comprises placing a plurality of de-cored products in a first row of the tote with de-cored ends of

each product in the first row facing a first side of the tote; **[pg. 7: 1 – 5; pg. 11: 18 – 23; pg. 17:18 – pg. 18:3; Figs. 1, 2, 3, 4]**

immersing the tote into a wash tank containing a washing fluid; and **[pg. 7:6 – 23; pg. 13: 6 – 19; pg. 18:7 – 20; Figs. 1, 2, 3, 4, 6]**

conveying the tote through the wash tank with the first side of the tote facing a direction of conveyance; **[pg. 6:20 – 22; pg. 20:8 – 15; pg. 23: 18 – 20; Fig. 8]**

whereby washing fluid flows through the de-cored end of each product to an opposite end of each product. **[pg. 6:20 – 22; pg. 20:8 – 15; pg. 23: 18 – 20; Fig. 8]**

70. A method of processing produce, comprising:

cutting a product from a stalk from which it was grown; **[pg. 7:1 – 5; pg. 11:3 – 4; pg. 15:12; Figs. 1, 3]**

removing a core from a core end of the product, forming a de-cored product; **[pg. 7:1 – 5; pg. 11: 6 – 14; pg. 15:12; Figs. 1, 3]**

pre-washing the de-cored end of the product; **[pg. 7:8 -9; pg. 16:12 – 22; Fig. 3]**

loading a plurality of de-cored products in a tote in a pre-aligned direction relative to the tote, wherein the tote includes openings large enough to allow the flow of a washing fluid through the tote and small enough to secure each product in the tote; **[pg. 7: 1 – 5; pg. 11: 18 – 23; pg. 17:18 – pg. 18:3; Figs. 1, 2, 3, 4]**

transporting the tote to a processing facility; **[pg. 17:6 – 17; Fig. 3]**

cleaning the de-cored product in the tote by placing a first side of the tote in a flow of washing fluid, whereby the flow of washing fluid flows through the de-cored end of each product to an opposite end of each product; **[pg. 7:6 – 23; pg. 13: 6 – 19; pg. 18:7 – 20; Figs. 1, 2, 3, 4, 6]**

loading the tote, directly from the washing fluid, without re-loading, to a spin dryer; and **[pg. 24:2 – 5; Fig. 8]**

drying each washed de-cored product in the tote in the spin dryer. **[pg. 15:14 – 17; pg. 24:2 – 5; Fig. 8]**

These mappings are illustrative only, and are provided as required, but are not intended to limit the scope or content of the claims beyond the specific language of the

claims. In addition, other portions of the specification and drawings may provide similar support for the claims as well.

Grounds of Rejection to be Reviewed on Appeal

The rejection of the pending claims, specifically, Claim 10 was rejected under 35 U.S.C. 112; Claims 1, 2, 4, 5, 7, 19, 22, and 66 – 69 were rejected under 35 U.S.C 103(a) as being unpatentable over Brown (US 2003/0126850 A1) in view of Brown, et al (US 6298865), Garcia, Jr., et al (US 6626192) Tarantino, et al (US 2004/0187465 A1), Mitchell, et al (US 6112429), Cress, et al (US 6223502) and Levy, et al (US 5566695).

Claim 6 was rejected under 35 U.S.C. 103(a) as being unpatentable over the references as applied to Claim 1, in further view of Hererra (US 2003/0217650). Claims 8 – 10, 12 and 15 were rejected under 35 U.S.C. 103(a) as being unpatentable over the references as applied to Claim 1 above, in further view of Hougham (US 5316778), Busta (US 3814820), Crossett (US 2666711), Bell et al. (US 1708253) and Alameda (US 5130152).

Claim 24 was rejected in further view of Terry (US 5711980). Claims 33 – 36, 40 – 41, and 70 – 72 were rejected in further view of Hougham. Claim 37 was rejected under 35 U.S.C 103(a) in further view of Fox et al. (US 2644473). Claims 38 – 39 were rejected under 35 U.S.C 103(a) as being unpatentable over the references applied to Claims 33 – 36, 40 – 41, 70 – 72, and in further view of Hougham, Busta, Crossett, Bell et al. and Alameda.

In addition, Claims 1, 2, 4, 5, 7 – 10, 12, 15, 19, 22, 33 – 41 and 66 – 72 were rejected under 35 U.S.C. 103(a) as being unpatentable over Mitchell et al. in view of Hougham, and in further view of Brown, Brown et al, Garcia Jr. et al. and Tarantino et al. Cress et al. and Levey et al. have been relied on as evidence. Claim 6 was rejected under 35 U.S.C. 103(a) over these references, and in further view of Hererra. Claim 24 was rejected under 35 U.S.C. 103(a) over these references, and in further view of Terry.

These rejections are respectfully traversed. The combination of the cited references fails to support the rejection of the pending claims.

ARGUMENT

A. Background

In general, the present invention is directed to methods for harvesting, washing, and drying cut vegetables and produce. As set forth, for example, in Claim 1, one embodiment of the present invention comprises:

> cutting a product from a stalk from which it was grown; removing a core of the product to form a de-cored product;
>
> placing the de-cored product in a tote, wherein the step of placing comprises placing a plurality of de-cored products in a first row of the tote with de-cored ends of the products in the first row facing a first side of the tote;
>
> cleaning the de-cored products in the tote by immersing the tote in a wash tank for cleaning, wherein the wash tank comprises a flow of washing fluid in a direction toward the de-cored ends of the products, such that the first side of the tote faces the direction of flow of washing fluid, whereby the flow of washing fluid flows through the de-cored end of each product to an opposite end of each product.

Thus, the present claims require, among other things, de-coring produce, placing the de-cored produce in a tote in a specific orientation, and immersing the tote in a wash tank having a directed fluid flow.

Despite the reliance on fifteen (15) cited prior art references, the Examiner has failed to establish that the present claims are *prima facie* obvious, since none of the cited 15 references, alone or in combination, teach the specific limitations of the present claims. Instead, the Examiner relies on impermissible hindsight reconstruction to attempt to find the specific limitations across numerous references. Even if the Examiner's combination could be deemed proper, which the Applicant respectfully argues that they are not, the combinations still fail to disclose the basic elements of the present invention.

B. Objection of language in Claim 10

Claim 10 has been objected to due to the phrase "transport vehicle." However, this term finds support in the specification on page 17, lines 6 – 17, wherein the step of transporting the produce from the field to the processing plant is described. This term is not the same as the "transport mechanism" term used to describe the device to transport

the tote through the washing device. Therefore, it is believed that this claim is definite as written.

C. Grounds of rejection for Claims 1, 2, 4, 5, 7, 19, 22, and 66 – 69 were rejected under 35 U.S.C 103(a) as being unpatentable over Brown (US 2003/0126850 A1) in view of Brown, et al (US 6298865), Garcia, Jr., et al (US 6626192) Tarantino, et al (US 2004/0187465 A1), Mitchell, et al (US 6112429), Cress, et al (US 6223502) and Levy, et al (US 5566695).

Impermissible Hindsight Reconstruction

While the Office Action admits that the present claims are not anticipated by any of the numerous cited references, the Office Action has combined these numerous references for supporting various obviousness rejections. More particularly, the Office Action has cited a total of 15 references, in various combinations, in an attempt to argue that the pending claims are obvious under 35 U.S.C. 103(a). However, the Office Action is based entirely on hindsight reconstruction using the Applicants' teachings and claims as a guide. The Federal Circuit has repeatedly held such a rejection is improper.

The Applicants are aware of the recent U.S. Supreme Court decision in KSR v. Teleflex, 550 U.S. 398 (2007), holding that the combinations of known elements can be found to be obvious, where there is no inventive skill required to make the combination. The KSR decision may have effectively weakened the prior "Teaching, Suggestion, Motivation" (TSM) standard. However, nothing in this decision appears to overturn the long-standing rule prohibiting hindsight reconstruction. In other words, using the Applicants' own teachings and claims as a guide to combine random elements found in the prior art is still prohibited. The Federal Circuit has recently noted:

> "We are mindful that in KSR, the Supreme Court made clear that a finding of teaching, suggestion, or motivation to combine is not a "rigid rule that limits the obviousness inquiry." 127 S.Ct. at 1741. This, however, does not alter the district court's pre-KSR conclusion in this case or our affirmance thereof. There was a complete absence of any proof that one skilled in the art would find the particular claimed method obvious based upon Dr. Patterson's list of prior art references or the knowledge generally available to those of ordinary skill in the art for any reason. We must still be careful not to allow hindsight reconstruction of references to reach the claimed invention without any explanation as to how or why the references would be combined to produce the claimed invention. Although Abbott cites KSR, it does not argue on appeal that a different result

would be reached in this case under KSR." *Innogenetics, N.V. v. Abbott Labs.*, 512 F.3d 1363, 1374 n.3 (Fed. Cir. 2008).

In addition, the Board of Patent Appeals and Interferences (BPAI) has similarly warned against reliance on KSR to undermine that long standing prohibition against hindsight reconstruction.

> "While the analysis under 35 U.S.C. § 103 allows flexibility in determining whether a claimed invention would have been obvious, KSR Int'l Co. v. Teleflex Inc., 550 U.S. 398, 418 (2007), it still requires showing that "there was an apparent reason to combine the known elements in the fashion claimed by the patent at issue." Id. "We must still be careful not to allow hindsight reconstruction of references to reach the claimed invention without any explanation as to how or why the references would be combined to produce the claimed invention." Innogenetics, N.V. v. Abbott Labs., 512 F.3d 1363, 1374 n.3 (Fed. Cir. 2008)."
>
> *Ex Parte Williams et al.*, Appeal No. 2009-000497 (BPAI Jul. 14, 2009).

> "'[R]ejections on obviousness grounds cannot be sustained by mere conclusory statements; instead, there must be some articulated reasoning with some rational underpinning to support the legal conclusion of obviousness.'" KSR Int'l. Co. v. Teleflex Inc., 127 S. Ct. 1727, 1741 (2007), quoting In re Kahn, 441 F.3d 977, 988 (Fed. Cir. 2006). See also In re Warner, 379 F.2d 1011, 1017 (CCPA 1967) ("A rejection based on section 103 clearly must rest on a factual basis, and these facts must be interpreted without hindsight reconstruction of the invention from the prior art"). The Examiner has not provided the required articulated reasoning with rational underpinning but, rather, appears to have rejected the Appellants' claims based upon impermissible hindsight in view of the Appellants' disclosure."
>
> *Ex Parte Ertel et al.*, Appeal No. 2009-1337 (Apr. 29, 2009).

It is undisputed that despite an extensive prior art record, the Office Action has failed to articulate, with rational underpinnings, why one of skill in the art would be able to view of the cited prior and know how to combine them without reliance on the Applicants' teachings. One of skill in the art would have to not only figure out which elements to combine, but also which elements, among the vast number in the prior references, should NOT be combined. The Patent Office is not permitted to use the Applicants' claims as "shopping list" into the prior art elements.

Prior Art Rejections

In any event, the cited combination of references fails to disclose the present invention as claimed. Even under the KSR decision, to establish a *prima facie* case of obviousness, each and every element of a claim must still be found in the prior art. For the reasons set forth below, the cited prior art fails to disclose certain of the present limitations. The main references relied on by the Examiner, as understood by the Applicants, are specifically discussed below.

Brown I (U.S. 20030126850)

The Brown reference fails to disclose that the de-cored produce are arranged in any particular order in the totes. Also, since the products are later sprayed with water from "above and below" (para. [0043]), there is no disclosure that the washing fluid necessarily flows from the de-cored end to an opposite end. Furthermore, the Brown reference fails to disclose using a washing tank as claimed in Claims 1, 33 and 69.

The Examiner seems to equate spraying water from both the top and the bottom as teaching the washing fluid necessarily flows from the de-cored end to an opposite end, since at least one set of nozzles would necessarily be spraying in the correct direction. However, the Brown reference must be taken as a whole, and there is nothing in it to suggest which set of nozzles (the upper or lower) could be removed. The Brown reference also actually teaches away from the present invention by failing to disclose the need/desire for a wash tank (i.e. Claim 1, 33 and 69) or immersing in a wash fluid (Claim 70) and instead teaches that spraying the produce is sufficient.

Brown, et al (US 6298865)

The Brown et al. reference similarly fails to teach or disclose placing the de-cored heads into a tote and immersing the totes in a wash tank and/or wash fluid. The Brown et al. reference merely teaches spraying the produce with an aqueous solution.

Garcia

As understood by the Applicants, Garcia similarly fails to disclose placing totes in a washing fluid. Merely spraying the produce is not the same as specifically placing the

produce in a washing fluid such that the washing fluid flows through the de-cored end. Clearly, Garcia fails to disclose the specific limitations of the present Claims.

Tarantino, et al

Tarantino et al. discloses a conveyor belt system for transporting produce. Techniques for topping and/or coring produce are also disclosed. However, there is no disclosure of de-coring produce and placing the produce in a particular orientation for washing in a washing fluid/wash tank.

Mitchell

As understood by the Applicants, Mitchell fails to disclose placing de-cored products into a tote, and aligning the de-cord ends against a side of the tote. As clearly shown in Fig. 2B of Mitchell reference, the core ends (the ends are not even "de-cored" ends) are placed towards the center of the tote, facing each other in two rows. In contrast, as shown in Figs. 6(A) and 6(B) of the present application, the de-cored ends are placed against the side of the tote (either in one or two rows as shown in the figures).

Moreover, since the products of Mitchell are not de-cored, the washing fluid cannot flow through the "de-cored ends" of the products.

Again, in order to "create" relevance for this reference, the Examiner has merely conveniently selected certain aspects of the reference, and ignored others.

The addition of Cress and/or Levy do not overcome the noted deficiencies in the main cited references.

D. Grounds of rejection for Claim 6 was rejected under 35 U.S.C. 103(a) as being unpatentable over the references as applied to Claim 1, in further view of Hererra (US 2003/0217650).

Claim 6 is allowable for at least the reasons advanced above with respect to Claim 1.

E. Grounds of rejection for Claims 8 – 10, 12 and 15 were rejected under 35 U.S.C. 103(a) as being unpatentable over the references as applied to Claim 1 above, in further view of Hougham (US 5316778), Busta (US 3814820), Crossett (US 2666711), Bell et al. (US 1708253) and Alameda (US 5130152).

Claims 8 – 10, 12 and 15 are allowable for at least the reasons advanced above with respect to Claim 1.

F. Grounds of rejection for Claim 24 was rejected in further view of Terry (US 5711980).

Claim 24 s allowable for at least the reasons advanced above with respect to Claim 1.

G. Grounds of rejection for Claims 33 – 36, 40 – 41, and 70 – 72 were rejected over the art discussed above in section C in further view of Hougham.

Hougham

The Hougham reference is directed to a technique whereby leafy vegetables have their leaves torn from the vegetable stems, and then the leaves are sorted into separate baskets. The separated leaves are then washed.

Hougham utterly fails to provide any disclosure to support the rejection of the present claims. In fact, most of the citations for support of the rejection do not make sense. For example, what is a "de-cored" end of a leaf, such that the fluid flow is directed to the de-cored end? The baskets are clearly not "totes", de-cored products are not arranged in any particular order, and the washing fluid does not pass through the product in any particular direction.

Therefore, Claims 33 – 36, 40 – 41 and 70 -72 are allowable for at least the reasons advanced above in Section B and in further view of the arguments over Hougham.

H. Grounds of rejection for Claim 37 was rejected under 35 U.S.C 103(a) in further view of Fox et al. (US 2644473).

Claim 37 is allowable for at least the reasons discussed above with respect to Claim 33. Fox et al. does not overcome the deficiencies of the reference discussed above.

I. Grounds of rejection for Claims 38 – 39 were rejected under 35 U.S.C 103(a) as being unpatentable over the references applied to Claims 33 – 36, 40 – 41, 70 – 72, and in further view of Hougham, Busta, Crossett, Bell et al. and Alameda.

Claims 38 – 39 are allowable for at least the reasons discussed above with respect to Claim 33. Hougham, Busta, Crossett, Bell et al. and Alameda do not overcome the deficiencies of the references discussed above.

J. Grounds of rejection for Claims 1, 2, 4, 5, 7 – 10, 12, 15, 19, 22, 33 – 41 and 66 – 72 were rejected under 35 U.S.C. 103(a) as being unpatentable over Mitchell et al. in view of Hougham, and in further view of Brown, Brown et al, Garcia Jr. et al. and Tarantino et al. Cress et al. and Levey et al. have been relied on as evidence.

Claims 1, 2, 4, 5, 7 -10, 12, 15, 19, 22, 33 – 41 and 66 – 72 are allowable for at least the reasons argued above in Section C. The Examiner has merely cited different combinations of the same basic references. However, as noted above, neither Mitchell et al., Hougham, Brown, Brown et al., Garcia Jr. et al., Tarantino et al., Cress et al. or Levey et al. disclose the present invention as claimed. Specifically, none of the cited reference teach or suggest de-coring produce, placing the produce in a particular orientation in a tote, and immersing the tote in wash tank/ washing fluid, such that the fluid washes through the produce.

K. Grounds of rejection for Claim 6 was rejected under 35 U.S.C. 103(a) over these references, and in further view of Hererra.

Claim 6 is allowable for at least the reasons argued above in Section J with respect to Claim 1.

L. Grounds of rejection for Claim 24 was rejected under 35 U.S.C. 103(a) over these references, and in further view of Terry.

Claim 24 is allowable for at least that reasons argued above in Section J with respect to Claim 1.

M. Summary:

A key failing of the combinations cited by the Office Action is that, taken as a whole, the references do not teach arranging the de-cored produce in a specific direction in totes, such that when immersed in wash tanks, the washing fluid can flow in a specific direction through the produce. These references do not disclose arranging the de-cored products in such a way that the de-cored ends face against a side of the tote. Nor do these references disclose that the washing fluid is specifically directed to flow through the de-cored end. Therefore, these references clearly do not anticipate the present claims. Since none of the references have the noted limitations, simply combining them (even using impermissible hindsight reconstruction) does not provide a disclosure of the specific limitations of the present claims.

Despite the citation and combination of 15 different references, the Office Action has failed to provide a specific citation to a reference which loads de-cored products into a tote with the de-cored edges facing against a side of the tote, and directing the washing fluid through the de-cored end. This factor alone tends to show that the present invention is not obvious in view of the prior art. Additional limitations not disclosed include conveying the tote through a wash tank with the de-cored ends in the direction of conveyance. Moreover, the references fail to disclose loading the de-cored products into two rows, with the de-cored ends facing the sides of tote.

The Examiner has argued that "one cannot show nonobviousness by attacking references individually where the rejections are based on combinations of references." However, this is exactly the problem with the Examiner's rejections – they are based on selecting individual elements from a multitude of references without support for WHY such a combination would, in fact, be obvious. The patent office cannot have it both ways – select individual elements from different references to show obviousness, while

objecting to arguments which point out the problems with each reference, when taken as a whole (i.e. teaching away, etc.).

For at least these reasons, the cited combination of references does not support the rejection of the pending claims. Therefore, it is believed that the present claims are now in condition for allowance.

Conclusion

The Examiner's rejection is clearly erroneous and should be reversed.

The Commissioner is hereby authorized to charge any fees (or credit any overpayment) associated with this communication and which may be required under 37 CFR §1.78 to Deposit Account No. 50-2603, **referencing Attorney Docket No. 351606.00500**.

Respectfully submitted,

REED SMITH LLP

Dated: April 12, 2010

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Appendix (Claims)

1. A method, comprising the steps of:

cutting a product from a stalk from which it was grown;

removing a core of the product to form a de-cored product;

placing the de-cored product in a tote, wherein the step of placing comprises placing a plurality of de-cored products in a first row of the tote with de-cored ends of the products in the first row facing a first side of the tote;

cleaning the de-cored products in the tote by immersing the tote in a wash tank for cleaning, wherein the wash tank comprises a flow of washing fluid in a direction toward the de-cored ends of the products, such that the first side of the tote faces the direction of flow of washing fluid, whereby the flow of washing fluid flows through the de-cored end of each product to an opposite end of each product.

2. The method according to Claim 1, wherein said step of removing comprises cutting the core off.

3. (Cancelled)

4. The method according to Claim 1, wherein said steps of removing, and placing are at a processing plant.

5. The method according to Claim 1, wherein a whole head nature of the product is retained.

6. The method according to Claim 1, wherein said step of removing comprises cutting out the core of the product using a stainless steel knife.

7. The method according to Claim 1, wherein said step of removing comprises cutting out the core of the product using a v-cut or other device for removing the core.

8. The method according to Claim 1, further comprising the step of pre-washing the cut product prior to placing it in the tote.

9. The method according to Claim 1, further comprising the step of spray washing at least one end of the product before placement in the tote.

10. The method according to Claim 9, further comprising the step of spray washing the product after placement in the tote and prior to transfer to a transport vehicle.

11. (Cancelled)

12. The method according to Claim 9, wherein a whole head nature of the product is retained from harvesting through washing, drying, and packaging.

13. (Cancelled)

14. (Cancelled)

15. The method according to Claim 12, wherein the de-cored products are placed in multiple rows on top of each other in the tote.

16. – 18. (Cancelled)

19. The method according to Claim 1, wherein said step of immersing comprises loading the tote on a conveyance device that carries the tote through a wash tank.

20. (Cancelled)

21. (Cancelled)

22. The method according to Claim 1, further comprising the step of spin drying the product in the tote;

wherein a whole head nature of the product is maintained from harvesting through washing, drying, and packaging.

23. (Cancelled).

24. The method according to Claim 22, wherein a temperature of the washing fluid and other equipment utilized in the washing, drying, and packaging equipment achieve a product temperature of approximately 33 - 38 degrees F.

25. – 32. (Cancelled)

33. A method, comprising the steps of:

cutting a product from a stalk from which it was grown;

removing a core from a core end of the product, forming a de-cored product;

pre-washing the de-cored end of the product;

loading the de-cored product in a tote in a pre-aligned direction relative to the tote, wherein a de-cored end of each of a plurality of products is placed against a side of the tote, and the tote includes openings large enough to allow the flow of a washing fluid through the tote and small enough to secure each product in the tote;

transporting the tote to a processing facility;

immersing the tote in a washing tank having washing fluid;

conveying the tote through the washing fluid with the de-cored ends of each product facing a direction of conveyance, the speed of conveyance sufficient to cause at least some of the washing fluid to flow through the de-cored end and out a leafy end of each product;

loading the tote, directly from the washing tank, without re-loading, to a spin dryer; and

drying each washed de-cored product in the tote in the spin dryer.

34. The method according to Claim 33, further comprising the step of packaging each washed and dried de-cored product.

35. The method according to Claim 33, wherein the washing fluid comprises one of chilled water, chlorine, and an anti-bacterial agent.

36. The method according to Claim 33, wherein:

the step of transporting comprises using a first conveyor belt; and

the method further comprises the steps of,

covering an open top end of the tote with a second conveyor belt, and

maintaining registration of the tote with the first conveyor belt by pressing it against the first conveyor belt with the second conveyor belt.

37. The method according to Claim 33, wherein the step of transporting comprises using a conveyor belt having one of latches and stops configured to maintain registration of the tote with the conveyor belt.

38. The method according to Claim 33, further comprising the step of spray washing ends of the product before loading in the tote.

39. The method according to Claim 33, further comprising the step of spray washing ends of the product after loading in the tote.

40. The method according to Claim 33, wherein said step of immersing comprises loading the tote on a transport mechanism configured to transport the tote through the washing tank.

41. The method according to Claim 40, wherein the transport mechanism is configured to transport the tote into a flow of washing fluid directed at the de-cored end of each product in the tote.

42. – 65. (Cancelled)

66. The method according to Claim 1, wherein the step of placing comprises placing a first row of the de-cored products in the tote with de-cored ends of each product in the first row facing a first side of the tote, and placing a second row of de-cored products in the tote with de-cored ends of each product in the second row facing a second side of the tote.

67. The method according to Claim 66, wherein the flow of washing fluid comprises a first flow directed at a first side of the tote and a second flow directed at a second side of the tote.

68. The method according to Claim 1, wherein said step of cleaning comprises placing the tote on a conveyance device that carries the tote through a wash tank.

69. A method of processing produce, comprising:

cutting a product from a stalk from which it was grown;

removing a core of the product to form a de-cored product;

placing the de-cored product in a tote, wherein the step of placing comprises placing a plurality of de-cored products in a first row of the tote with de-cored ends of each product in the first row facing a first side of the tote;

immersing the tote into a wash tank containing a washing fluid; and

conveying the tote through the wash tank with the first side of the tote facing a direction of conveyance;

whereby washing fluid flows through the de-cored end of each product to an opposite end of each product.

70. A method of processing produce, comprising:

cutting a product from a stalk from which it was grown;

removing a core from a core end of the product, forming a de-cored product;

pre-washing the de-cored end of the product;

loading a plurality of de-cored products in a tote in a pre-aligned direction relative to the tote, wherein the tote includes openings large enough to allow the flow of a washing fluid through the tote and small enough to secure each product in the tote;

transporting the tote to a processing facility;

cleaning the de-cored product in the tote by placing a first side of the tote in a flow of washing fluid, whereby the flow of washing fluid flows through the de-cored end of each product to an opposite end of each product;

loading the tote, directly from the washing fluid, without re-loading, to a spin dryer; and

drying each washed de-cored product in the tote in the spin dryer.

71. The method according to Claim 70, wherein the step of loading comprises placing a first row of de-cored products in the tote with de-cored ends of each product in the first row facing a first side of the tote, and placing a second row of de-cored products in the tote with de-cored ends of each product in the second row facing a second side of the tote.

72. The method according to Claim 71, wherein the flow of washing fluid comprises a first flow directed at a first side of the tote and a second flow directed at a second side of the tote.

Evidence Appendix

Attached hereto is a true and correct copy of:

Entered by Examiner in Office Action mailed 09/21/2007:

Brown (US 2003/0126850 A1)

Brown, et al. (US 6298865)

Garcia, Jr., et al. (US 6626192)

Mitchell, et al. (US 6112429)

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Hougham (US 5316778)

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Cress, et al. (US 6223502)

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Tarantino, et al. (US 2004/0187465 A1)

Crossett (US 2666711)

Alameda (US 5130152)

Fox et al. (US 2644473)

Related Proceedings Appendix

Not applicable.

July 7, 1953 G. B. FOX ET AL 2,644,473

DISHWASHER

Filed May 16, 1950 3 Sheets-Sheet 1

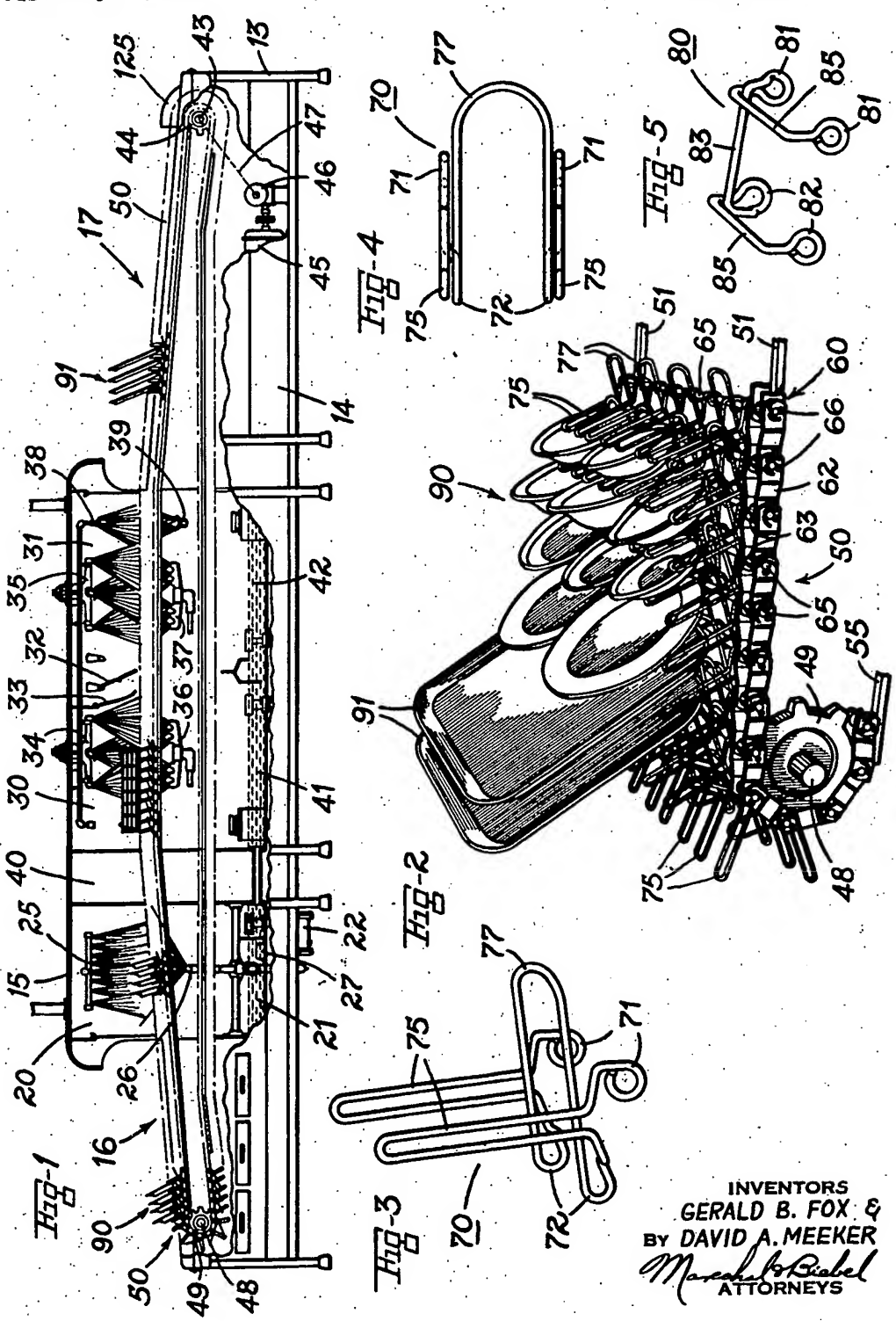

Fig-1

Fig-4

Fig-5

Fig-2

Fig-3

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DISHWASHER

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Fig-6

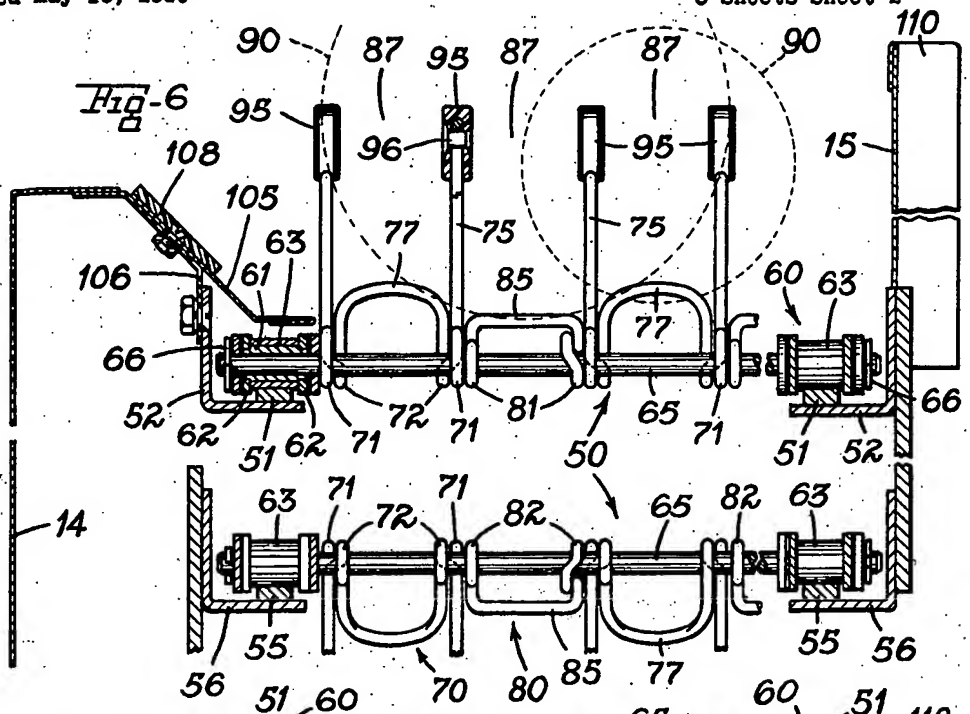


Fig-7

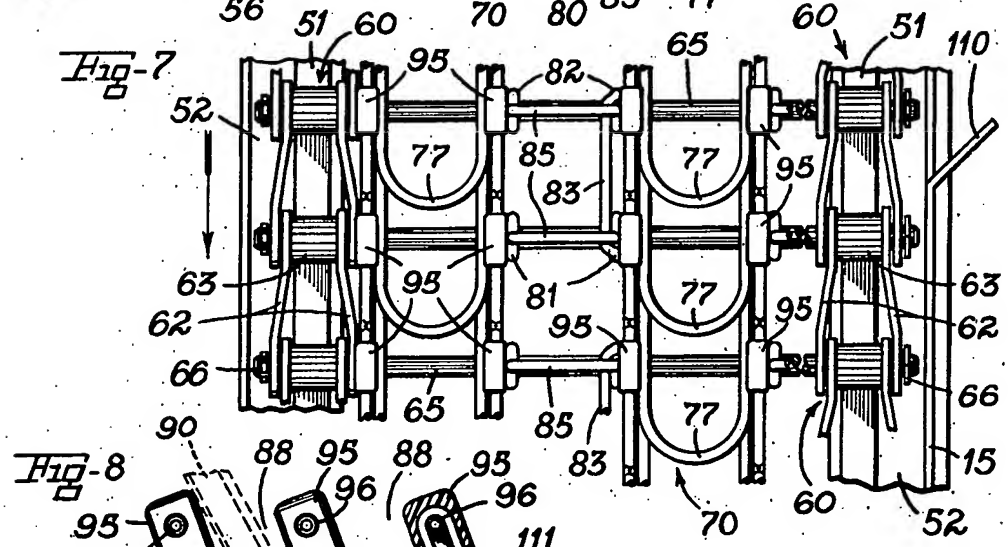
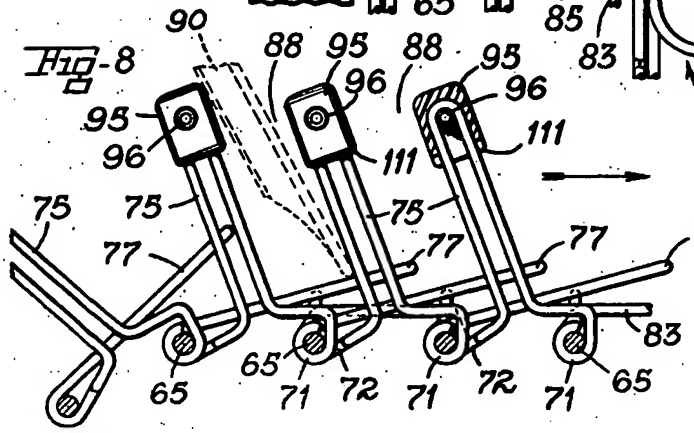


Fig-8



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DISHWASHER

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Fig-9

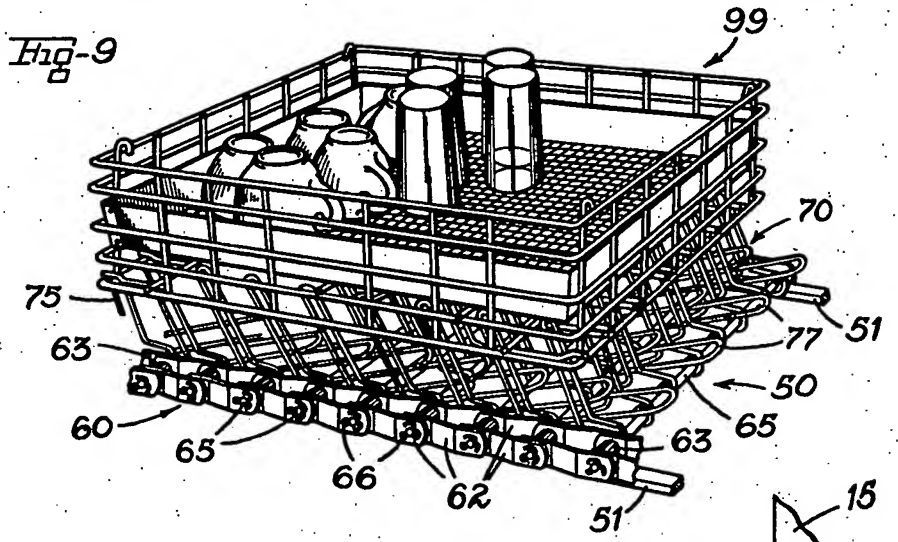


Fig-10

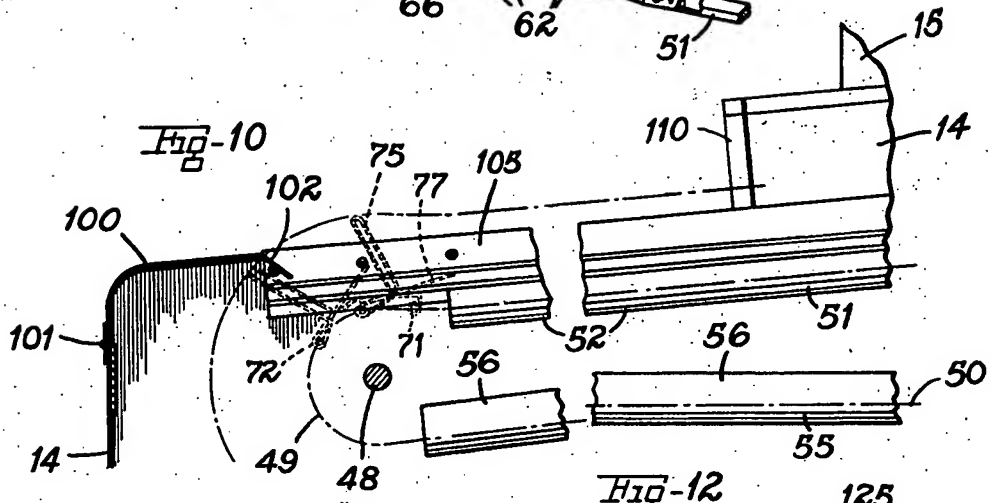


Fig-11

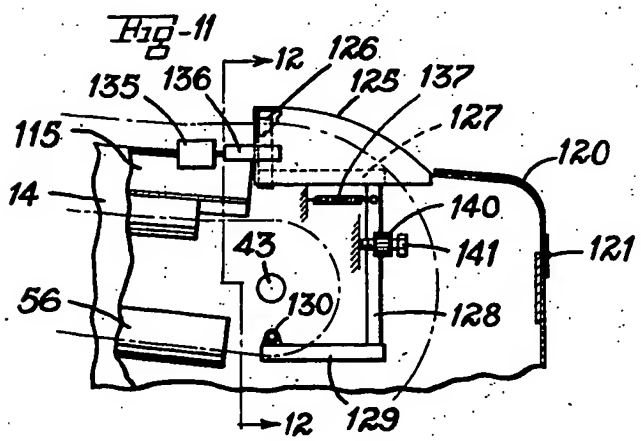
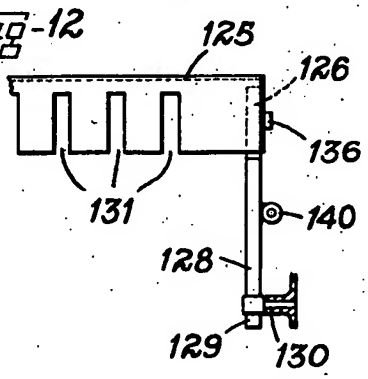


Fig-12



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Patented July 7, 1953 2,644,473

UNITED STATES PATENT OFFICE

2,644,473

DISHWASHER

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Application May 16, 1950, Serial No. 162,358

19 Claims. (Cl. 134—72)

1

This invention relates to dishwashers and more particularly to dishwashers of the continuous, open conveyor type.

In accordance with the present invention, a conveyor for a dishwasher is provided which does not require the use of racks, although racks may be used upon the conveyor, in whole or in part, as desired. The conveyor is of such construction that the dishes may be positioned upon it directly, and conveyed through the machine while being held properly and with such yielding support as to prevent likelihood of damage or breakage. The position of the dishes during their travel through the machine is essentially upright, or somewhat inclined, thus assuring complete drainage of the wash fluids before the dishes leave the machine. Furthermore, the construction of the conveyor is essentially open throughout its entire extent so that the dishes may be placed as desired directly upon the conveyor, and so that the wash sprays have full and complete access thereto, regardless of the particular location of the dishes thereon. It is likewise important that by reason of this essentially open construction of the conveyor, the wash arms are located above and below the conveyor and arranged to discharge their wash sprays directly upwardly and downwardly upon the dishes, through the conveyor in the case of the lower wash arms, the open construction making possible this free passage of the sprays through the conveyor without substantially reducing the effectiveness thereof. The conveyor is thus rapid and easy to load and unload, fully protects the dishes during their travel through the machine, and provides for a highly effective washing action from wash arms located conveniently above and below the conveyor with respect to both flat ware and hollow ware as well as silver.

In accordance with the present invention, there is provided a continuous conveyor adapted to be driven through the washing and rinsing compartments of the dishwashing machine, and this conveyor is equipped with dish supporting and separating members which include upwardly projecting finger portions arranged in spaced and aligned relation both laterally and longitudinally of the conveyor to define dish receiving recesses. These members are of such construction that the dish receiving spaces or recesses defined by their finger portions provide adequate support for each dish, tray or like article during passage through the dishwashing machine in any position in which the article is mounted on the conveyor, i. e., either laterally or longitudinally of its direction of movement, and it is accordingly not necessary for the operator or attendant to load the dishes into a rack, since they may be placed directly on the web and without requiring any special orientation thereon.

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The separating members on the conveyor are of sufficiently resilient construction and are so arranged with respect to the structural members of the conveyor that they provide resilient support for the dishes and maintain them out of contact with the body of the conveyor. This further facilitates rapid loading and unloading of the dishes and provides protection against damage such as might result if a dish were accidentally dropped into direct contact with rigid structural parts of the conveyor. Furthermore, the separating fingers of these supporting members are so arranged that if desired a rack of the usual type may be placed thereon, as may be desirable for handling silverware or otherwise, and the rack will be safely supported during travel with the conveyor through the washing and rinsing cycle.

It is accordingly one of the principal objects of the present invention to provide a conveyor of essentially open construction which is adapted for continuous driving through the washing and rinsing sections or chambers of a dishwasher and which includes separating members arranged to support the dishes in generally vertical position during washing and rinsing to facilitate access to the dishes by the generally vertically directed wash sprays for effective washing, rinsing and draining.

An additional object is to provide such a conveyor wherein the dish supporting and separating members are arranged to provide dish receiving recesses which extend both laterally and longitudinally of the direction of travel of the conveyor for quick and easy loading and unloading.

Another object is to provide a continuous conveyor for a dishwasher which includes resiliently yieldable portions forming supports for the dishes and other articles to be washed to maintain the dishes out of contact with the structural parts of the conveyor for protection against shock during loading and transporting of the dishes.

It is also an object of the invention to provide such a conveyor wherein each of the dish supporting and separating members is formed of a single length of resilient wire formed to provide the desired dish separating and dish supporting portions.

Other objects and advantages of the invention will be apparent from the following description, the accompanying drawings and the appended claims.

In the drawings—

Fig. 1 is a diagrammatic side view, partly broken away, showing a dishwashing machine embodying a continuous conveyor unit in accordance with the present invention;

Fig. 2 is an enlarged perspective view showing a fragment of the conveyor unit loaded with dishes and trays to be washed;

Figs. 3 and 4 are enlarged detail views in perspective and plan, respectively, showing one of the flight wires of the conveyor;

Fig. 5 is an enlarged detail view in perspective showing one of the members which separate the flight wires transversely of the conveyor;

Fig. 6 is an enlarged and somewhat diagrammatic view in vertical section through the dishwasher of Fig. 1;

Fig. 7 is a fragmentary view on the same scale as Fig. 6 looking downwardly on the conveyor;

Fig. 8 is a fragmentary view in side elevation illustrating diagrammatically the action of the conveyor in passing over one of the sprockets at the loading end of the machine;

Fig. 9 is a fragmentary perspective view illustrating the operation of the conveyor in conjunction with a dish supporting tray;

Fig. 10 is a fragmentary and somewhat diagrammatic view on a larger scale than Fig. 1 showing the loading end of the dishwasher;

Fig. 11 is a view similar to Fig. 10 showing the unloading end of the dishwasher and illustrating the safety switch mechanism for stopping the dishwasher in the event of incomplete unloading of the conveyor; and

Fig. 12 is a fragmentary section on the line 12—12 of Fig. 11.

Referring to the drawings, which illustrate a preferred embodiment of the invention, Fig. 1 shows an automatic dishwashing machine which includes a base frame indicated generally at 13, a casing 14 and a hood 15 located between the open loading end portion 16 and unloading end portion 17 of the machine. Within the hood and adjacent the leading end 16 of the machine is a scrapping chamber 20 which includes a sump 21 provided with a pump 22 for recirculating the water from the sump to the upper spray headers 25 and lower discharge manifold 26 for discharge over the dishes as they pass through chamber 20 to wash off particles of food. These particles are washed down into the sump for subsequent removal, the pump being provided with a suitable easily removable filter 27 to prevent recirculation of the scraps.

The hood 15 also encloses the washing chamber 30 and rinsing chamber 31, which are in continuous communication except for the usual deflector 32 and flexible curtain 33 positioned between the revolving wash arms 34 and rinse arms 35, and which are also shown as provided with lower wash arms 36 and 37 and a final rinse header 38 and lower rinse manifold 39. In order to guard against access of particles from the scrapping chamber to the wash and rinse chambers, a space 40 is provided within the hood between chambers 20 and 30, and the washing and rinsing chambers have sumps 41 and 42 separate with the sump 21 of the scrapping chamber.

A shaft 43 supporting a pair of sprockets 44 is mounted at the unloading end of the frame and is driven by a motor 45 and speed reducer 46 as indicated at 47. A similar shaft 48 provided with sprockets 49 is mounted at the loading end of the frame, and the conveyor 50 extends around these sprockets for driving continuously through the hood 15. The advancing flight of the conveyor is supported on a pair of tracks 51 carried by brackets 52 mounted in the frame, and it will be noted that these tracks are inclined upwardly from the loading end of the machine to a point just within the entering end of the washing chamber and then remain level to approximately the discharge end of the rinse chamber, from which point they are inclined downwardly to the unloading end of the machine. The return flight of the conveyor is similarly supported on tracks 55 carried by brackets 56 secured to the frame.

The construction of the conveyor 50 is shown in detail in Figs. 2 to 8. It includes a pair of continuous pintle chains 60 which form the side members of the conveyor and engage the sprockets 44 and 49. Each of the individual links of the chain includes a bushing 61 (Fig. 6) riveted between the arm members 62 and forming a bearing for a roller 63 adapted to ride on the tracks 51 and 55. A plurality of cross rods 65 are secured to the chains 60 in spaced relation longitudinally of the conveyor to form the desired open framework for free passage of water. Each of the cross rods is shown as having its ends received in the bushing portions 61 in an opposite pair of links in the two chains and being secured in place by means such as cotter pins 66.

A plurality of individual flight wires indicated generally at 70 (Figs. 3 and 4) are mounted on the conveyor to form supporting and separating members for the dishes and other articles to be washed. Each of the individual flight wires 70 is shown as formed from a single length of wire, and it includes a forward pair of loops 71 adapted to receive one of the cross rods 65, a rearward pair of loops 72 adapted to receive an adjacent cross rod, a pair of upwardly projecting fingers 75 which are inclined rearwardly with respect to a plane through the centers of the loop portions 71 and 72, and an upwardly inclined loop portion 77 located between the fingers 75 and extending forwardly thereof from the loops 72 beyond the loops 71.

It will thus be seen that when these flight wires are mounted on the cross rods 65 as shown in Fig. 8, the fingers 75 incline rearwardly with respect to the upper surface of the conveyor, and the loop 77 on each flight wire 70 extends forwardly beyond and in vertically spaced relation with the rod on which the loop portions 71 of the same flight wire are mounted. It will also be noted that the loops 72 are offset inwardly with respect to the loops 71 to provide for overlapping the loop portions 72 of each flight wire by the loop portions 71 of the next adjacent flight wire to the rear, and with each flight wire thus mounted on two of the cross rods 65, it is supported with its fingers 75 in proper upright position while advancing through the dishwasher but is still able to negotiate the turns at the ends of the machine as shown in Fig. 8.

Spacers 80 (Fig. 5) are provided between adjacent flight wires 70 laterally of the conveyor, and each of these spacers is shown as similarly formed from a single length of wire. It will be seen that each spacer includes a forward pair of loops 81

adapted to receive one of the cross rods 65, a similar rearward pair of loops 82, a longitudinally extending connecting portion 83 and a pair of laterally extending portions 85 arranged above the connecting portion 83. These spacers are mounted on each pair of cross rods 65 between the flight wires 70 as shown in Figs. 6 and 7, and they thus serve to maintain the flight wires in spaced relation laterally of the conveyor.

It will accordingly be seen that with the conveyor constructed as described and shown, the fingers 75 on the flight wires are aligned in spaced relation both longitudinally and laterally of the conveyor in such manner as to define a plurality of longitudinally extending recesses 87 and laterally extending recesses 88 for receiving the articles to be washed. Thus as shown in Fig. 2, the recesses 88 can be loaded with dishes 90 of different sizes and shapes as well as with larger articles such as the trays 91, and the fingers 75 are of sufficient height and sufficiently closely spaced to support these articles properly during passage through the scrapping, washing and rinsing chambers. The longitudinally extending recesses 87 can be similarly employed for receiving articles to be washed, particularly for large articles such as trays and the like which may be too long to be mounted crosswise of the conveyor.

With the flight wires and spacers 80 constructed and arranged as shown, positive protection is provided against contact between any of the dishes and the relatively stiff or rigid cross rods 65. The loops 77 on the flight wires interfit as shown in Fig. 7 in such manner that each loop extends above one of the cross rods, and with the flight wires formed of resilient wire, the loops thus form resilient supports which act to cushion the dishes during loading and unloading of the conveyor, even if the dishes should be accidentally dropped into place. The loops 77 thus cushion all of the lateral recesses 88 as well as alternate longitudinal recesses 87, and in the longitudinal recesses which do not contain the loops, the portions 85 of the spacers 80 similarly act as resilient supports for the dishes. In addition, the fingers 75 may be provided as shown in Figs. 6 to 8 with guard caps 95 of flat, thimble-like shape, formed of a suitable material such as nylon or other plastic, each of these guards being held on the finger by a rivet 96 and providing a cushion on the upper end of the finger.

The preferred manner of stacking the dishes is indicated in Fig. 2, i. e., the dishes 90 and trays 91 being received upon the conveyor with their long dimensions extending crosswise thereof. In this position the flat sides of the articles are engaged against the fingers 75 while the lower edges are supported upon the parts 77 which extend generally in the direction of travel of the conveyor. It will be evident by reference to the drawing that the parts 77 are arranged in rows with the loops on one cross bar overlapping those on the next adjacent bar. It will also be clear that the spacing crosswise between the alternate rows of loops 77 is such that whatever position is occupied by the dish, that is, whether it is directly above a loop, or whether it is positioned in the row which does not carry such loops and hence between the rows of loops 77, it will in either case be supported by and upon these loops in such manner that it is not allowed to rest upon or come into direct contact with the relatively rigid bars 65. This is further assured by the provision of the spacer portions 85 which are arranged in the alternate rows between loops 77, and which provide for receiving and supporting the edges of the dishes if they should be located in that position.

Similarly, while not preferred, the dishes may be stacked with their long dimensions lengthwise of the travel of the conveyor. In this case the arrangement of the loops 77 and the spacer portions 85 is likewise such that at no time are the dishes allowed to rest directly upon the cross bars 65.

This conveyor unit is particularly adapted for use in dishwashers employed in restaurants and like establishments utilizing large quantities of dishes and trays, and for such uses a satisfactory size for the conveyor is an overall width for the conveyor 50 of approximately twenty inches, with adjacent cross rods 65 having their centers approximately $2\frac{1}{16}$ inches apart. With the body of the conveyor of these proportions, adequate support for the dishes and trays is obtained with each of the fingers 75 inclined at approximately 70° to the plane of the conveyor and extending upwardly to a distance of approximately four inches above the centers of the rearward loop portions 72, and with the loops portions 77 approximately two inches in width and inclined at approximately 15° upwardly from the plane of the conveyor. This arrangement provides for four rows of loops 77 with three rows of spacers 80 alternating between them.

It should also be noted that this conveyor is adapted for use with dish racks of the type commonly used in commercial dishwashers. Fig. 9 shows a rack 99 of this type mounted on the conveyor, and it will be seen that the rack readily seats on the upper ends of the fingers 75 for travel with the conveyor through the dishwasher. Such a rack may be conveniently employed for silverware, glasses, cups and like small articles while the dishes and trays are mounted directly in the recesses 87 and 88 as described.

In order to prevent premature loading of the conveyor such as might cause dishes to be caught between adjacent lateral rows of flight wires as the conveyor passes around sprockets 49, the casing 14 is provided with a hood 100 (Fig. 10) hinged at 101 to casing 14 at the loading end 16 of the machine which extends into the path of the flight wires and is provided with a down-turned flange having cutouts 102 through which the fingers 75 pass. This hood 100 is so proportioned, that it prevents loading of the dishes onto the conveyor until the web has substantially completely passed around the sprockets 49 and started up the inclined portion of the tracks 51.

Additional protection is provided at the loading end of the dishwasher by a flange 105 (Fig. 6) at each side of the machine mounted on a downwardly extending bracket 106 secured to the casing 14. This flange 105 extends laterally inwardly to form a cover over the chains 60, and its inclined portion is provided with a longitudinally extending plate 108 of Bakelite or like hard plastic material which serves as a guide and support for any dishes or other articles which accidentally may overhang or extend beyond the sides of the conveyor. In the event that any of the articles to be washed do thus extend too far laterally, they are cammed back into proper position as they enter the scrapping chamber 20 by an angularly arranged flange 110 (Figs. 6 and 7) mounted at both sides of the entering end of the casing 15. Also with the fingers 75 inclined rearwardly at a substantial angle which is a sliding angle for materials employed, such

camming action will take place without damage to the fingers, since an improperly positioned tray, dish tote box or other article being washed will not jam as could occur if the fingers were vertical but instead will be able to slide upwardly as well as laterally to the extent necessary for movement to a proper position on the conveyor. Such upward movement of the articles is facilitated by the resilient construction of the fingers, which permits them to yield further as required, and also by the rounded corners 111 on the guard caps 95.

The open portion of the dishwasher at the unloading end 17 is provided with flanges 115 (Fig. 11) similar to the flange 105. In addition, provision is made for stopping movement of the conveyor in the event that any of the dishes are inadvertently not removed at the unloading end of the machine. A hood 120 is hinged at 121 to the end of casing 14. An additional hood 125 is mounted forwardly of hood 120 within the casing, and it is hinged separately from hood 120 by means of the support bars 126, 127, 128 and 129 and pivots 130. The downwardly extending front flange portion of this hood 125 is provided with slots 131 adapted to receive the fingers 75 of the flight wires 70.

A switch 135 in the operating circuit to motor 45 is mounted on the side of casing 14 as shown in Fig. 12, and a switch bar 136 is secured to the side of hood 125 for operating this switch, the arrangement in the circuit being such that when the switch bar 136 is in position closing switch 135, the motor will operate when its starting switch is closed. Springs 137 are secured to the support bars 128 in position to draw the hood 125 forwardly and thus to cause switch bar 136 to close switch 135. The bars 128 also carry adjusting nuts 140 which receive the adjustable stop bolts 141 for adjusting the normal position of the hood, ready access being provided to these bolts by way of the hood 120.

It will thus be seen that under normal conditions, the springs 137 hold the hood 125 in such position that the switch bar 136 closes switch 135 and thus maintains the dishwasher in operation. However, if a dish is inadvertently left in the conveyor and carried against the front portion of hood 125, the hood will tilt against springs 137 until switch bar 136 is out of contact with the switch 135, whereupon the switch will open to interrupt the operating circuits of motor 45 and thus stop the machine until the dish is removed.

While the form of apparatus herein described constitutes a preferred embodiment of the invention, it is to be understood that the invention is not limited to this precise form of apparatus, and that changes may be made therein without departing from the scope of the invention which is defined in the appended claims.

What is claimed is:

1. A continuous conveyor adapted for use in a dishwasher of the character described comprising a pair of continuous side members movable through a wash chamber, a plurality of cross members secured to said side members in spaced relation longitudinally of said side members to provide an essentially open construction for free passage of wash sprays therethrough, means forming a plurality of spaced fingers extending upwardly from said cross members in aligned relation across said conveyor to define a plurality of laterally arranged recesses for receiving dishes to be washed in generally upright position for free access thereto by said wash sprays passing through said conveyor, means for maintaining said fingers in spaced and aligned relation defining a plurality of similar dish receiving recesses arranged longitudinally of said conveyor, and means on said conveyor cooperating with said fingers to support said dishes in each said plurality of recesses out of contact with said cross members.

2. A continuous conveyor adapted for use in a dishwasher of the character described adapted to contain means for discharging wash sprays upon the dishes from above and below the same, comprising a pair of continuous side members movable through a wash chamber, a plurality of cross members secured to said side members in spaced relation longitudinally of said side members to provide an essentially open construction for free passage of said wash sprays therethrough, means forming a plurality of fingers extending upwardly from said cross members in aligned relation across said conveyor to define a plurality of laterally arranged recesses for receiving dishes to be washed in generally upright position for free access thereto by said wash sprays passing through said conveyor, means for maintaining said fingers in spaced and aligned relation defining a plurality of similar dish receiving recesses arranged longitudinally of said conveyor, and yieldable means in each of said recesses for resiliently supporting said dishes in spaced relation with said cross members.

3. A continuous conveyor adapted for use in a dishwasher of the character described comprising a pair of continuous side members movable through a wash chamber, a plurality of cross members secured to said side members in spaced relation longitudinally of said side members to provide an essentially open construction for free passage of wash sprays therethrough, a plurality of yieldable wire separator members mounted on said cross bars to form guides and supports for receiving the dishes, said separator members including upwardly extending fingers arranged in predetermined spaced relation over the surface of said conveyor for receiving the dishes edgewise therebetween in generally upright position, and said separator members also including portions extending generally longitudinally of said conveyor in upwardly spaced relation with said cross members on which the dishes are adapted to rest.

4. A continuous conveyor for use in a dishwasher of the character described comprising a pair of continuous side members movable through a wash chamber, a plurality of cross members secured to said side members in spaced relation longitudinally of said side members to provide an essentially open construction for free passage of wash sprays therethrough, driving and supporting means for said conveyor at the ends of the dishwasher around which said conveyor is adapted to turn, and a plurality of separating members supported on said cross members, said separating members including upwardly extending fingers arranged in predetermined spaced relation over the surface of said conveyor for receiving the dishes edgewise therebetween to support said dishes in generally upright position for free access thereto by said wash sprays directed upon said dishes from above and below said conveyor, each of said separating members including portions mounted on two of said cross members to maintain said fingers in upwardly extending position during travel through said

wash chamber while allowing free turning of said conveyor around said supporting and driving means.

5. A continuous conveyor adapted for use in a dishwasher of the character described comprising a pair of continuous flexible side members, a plurality of cross members secured to said side members in spaced relation longitudinally of said side members, a plurality of separating members for the articles to be washed each including an upwardly projecting finger and a longitudinally projecting resilient loop portion, means for mounting said separating members on said conveyor with said fingers thereon in substantially aligned and spaced relation both laterally and longitudinally of said conveyor to define a plurality of recesses arranged both laterally and longitudinally of said conveyor for receiving articles to be washed in upright position, each of said loop portions being located in one of said longitudinal recesses and being of sufficient length to overlap said loop portion of at least one of said separating members adjacent thereto longitudinally of said conveyor to assure the presence of a plurality of said loops in each of said laterally arranged recesses for resiliently supporting the dishes positioned in said recesses.

6. A continuous conveyor adapted for use in a dishwasher of the character described comprising a pair of continuous side members, a plurality of cross members secured to said side members in spaced relation longitudinally of said side members to provide an essentially open construction for free passage of wash sprays therethrough, a plurality of wire separator members mounted on each of said cross members, said separator members including upwardly extending fingers aligned laterally of said conveyor and cooperating to form laterally arranged recesses for receiving dishes edgewise therein, said separator members including longitudinally extending portions forming resilient supports for the dishes placed in said lateral recesses, and wire spacers arranged on said cross members between adjacent said separator members to maintain said separator members in spaced and aligned relation with said fingers thereon defining longitudinally arranged recesses for receiving dishes, said spacers including resilient portions located above said cross members for resiliently supporting said dishes.

7. A continuous conveyor for use in a dishwasher comprising a pair of continuous side members at either side of the conveyor, a series of cross bars extending across the conveyor from one of said side members to the other, yieldable wire separator members mounted on said cross bars forming guides and supports for receiving the dishes thereon and therebetween, said separator members including upwardly extending and rearwardly inclined fingers arranged in predetermined spaced relation over the surface of said conveyor for receiving the dishes edgewise therebetween, and said separator members also including parts extending generally longitudinally of said conveyor on which the dishes are adapted to rest.

8. A continuous conveyor for use in a dishwasher which comprises a pair of continuous side members at either side of the conveyor, a series of cross bars extending across the conveyor from one of said side members to the other, yieldable wire separator members mounted on said cross bars forming guides and supports for receiving the dishes thereon and therebetween, said separator members including upwardly extending fingers arranged in predetermined spaced relation over the surface of said conveyor for receiving the dishes edgewise therebetween, said separator members also including parts extending generally longitudinally of said conveyor and arranged in rows with the spaces between the rows being such that the dishes when supported edgewise on said parts are held in position above and substantially out of contact with said bars.

9. A continuous conveyor for use in a dishwasher which comprises a pair of continuous side members at either side of the conveyor, a series of cross bars extending across the conveyor from one of said side members to the other, yieldable wire separator members mounted on said cross bars forming guides and supports for receiving the dishes thereon and therebetween, said separator members including upwardly extending fingers arranged in predetermined spaced relation over the surface of said conveyor for receiving the dishes edgewise therebetween, said separator members also including parts extending generally longitudinally of said conveyor on which the dishes are adapted to rest, said parts being in the form of loops arranged in rows longitudinally of the conveyor with the loops on one bar overlapping those of the next adjacent bar.

10. A continuous conveyor for use in a dishwasher which comprises a pair of continuous side members at either side of the conveyor, a series of cross bars extending across the conveyor from one of said side members to the other, yieldable wire separator members mounted on said cross bars forming guides and supports for receiving the dishes thereon and therebetween, said separator members including upwardly extending fingers arranged in predetermined spaced relation over the surface of said conveyor for receiving the dishes edgewise therebetween, said separator members also including parts extending generally longitudinally of said conveyor on which the dishes are adapted to rest, said parts being in the form of loops located in rows between alternate pairs of said fingers, the space between said rows being such that the dishes when positioned edgewise on the loops of two spaced rows will be supported above the bars between said rows.

11. A continuous conveyor for use in a dishwasher which comprises a pair of continuous side members at either side of the conveyor, a series of cross bars extending across the conveyor from one of said side members to the other, yieldable wire separator members mounted on said cross bars forming guides and supports for receiving the dishes thereon and therebetween, said separator members including upwardly extending fingers arranged in predetermined spaced relation over the surface of said conveyor for receiving the dishes edgewise therebetween, said separator members also including parts extending generally longitudinally of said conveyor and arranged in rows with the space between the rows being such that dishes supported edgewise on said parts are held in position above and substantially out of contact with said bars, and yieldable means on the bars between said rows of loops for preventing direct contact of the dishes with said bars.

12. In a continuous conveyor of the character described for use in a dishwasher, a plurality of flight wires for supporting and separating the articles to be washed, each of said flight wires being formed to provide a pair of upwardly projecting fingers, an open conveyor framework,

means for mounting said flight wires on said framework, and means for maintaining said flight wires in predetermined spaced relation along said framework with said fingers thereon aligned both longitudinally and laterally of said framework to define a plurality of dish receiving recesses arranged both laterally and longitudinally thereof.

13. In a continuous conveyor of the character described for use in a dishwasher, a plurality of flight wires for supporting and separating the articles to be washed, an open conveyor framework, each of said flight wires including a pair of upwardly projecting and laterally spaced finger portions and a forward pair of foot portions adapted to be secured to said framework, each of said flight wires also including a rearward pair of foot portions and a resilient loop portion extending longitudinally from one of said pairs of foot portions, and means for maintaining said flight wires in laterally and longitudinally spaced relation of said framework with said fingers thereon defining a plurality of recesses for receiving articles to be washed and with said loop portions thereof forming resilient supports for the articles received in said recesses.

14. In a continuous conveyor adapted for use in a dishwasher of the character described, an open conveyor framework, a plurality of flight wires mounted on said framework and each including a pair of upwardly projecting fingers and a longitudinally arranged resilient loop portion, a plurality of spacer members positioned between adjacent said flight wires laterally of said web to maintain said flight wires in spaced and aligned relation with said fingers forming a plurality of laterally and longitudinally arranged recesses for receiving articles to be washed, said loop portions of said flight wires being arranged in certain of said recesses to form resilient supports for said articles, and said spacers including resilient portions forming resilient supports for said articles in the others of said recesses.

15. In a continuous conveyor of the character described for use in a dishwasher, a plurality of flight wires for supporting and separating the articles to be washed, said flight wires being formed to provide upwardly projecting fingers, an open conveyor framework, means for mounting said flight wires on said framework, means for maintaining said flight wires in predetermined spaced relation along said framework with said fingers thereon aligned both longitudinally and laterally of said framework to define a plurality of dish receiving recesses arranged both laterally and longitudinally thereof, and a guard cap secured to the upper end of each said finger to form a cushion preventing direct contact between the upper ends of said fingers and the dishes being loaded in said recesses.

16. In a continuous conveyor adapted for use in a dishwasher of the character described, an open conveyor framework, a plurality of flight wires mounted on said framework and each including a pair of upwardly projecting elongated loops forming fingers and a longitudinally arranged resilient loop portion, a generally thimble shaped cap mounted on the upper end of each said finger, means extending laterally through said cap and said fingers to secure said cap in place, a plurality of spacer members positioned between adjacent said flight wires laterally of said web to maintain said flight wires in spaced and aligned relation with said fingers forming a plurality of laterally and longitudinally arranged recesses for receiving articles to be washed, said loop portions of said flight wires being arranged in certain of said recesses to form resilient supports for said articles, and said spacers including resilient portions forming resilient supports for said articles in the others of said recesses.

17. A dishwasher of the character described comprising a continuous conveyor, a plurality of spaced generally upwardly extending fingers on said conveyor for receiving therebetween and supporting dishes and other articles to be washed, and means for driving said conveyor forwardly to carry the articles thereon through wash sprays, said fingers being inclined rearwardly at a sliding angle with relation to the path of travel of said conveyor to effect upward camming motion thereon of an article supported therebetween in the event of contact between said article and a stationary obstruction adjacent the path of said conveyor for release of said fingers and continuance of said forward travel of said conveyor.

18. In a dishwasher including a housing forming a wash chamber opening at both ends thereof, the combination of a continuous conveyor, a plurality of spaced generally upwardly extending fingers on said conveyor for receiving therebetween and supporting dishes and other articles to be washed, means for driving said conveyor forwardly to carry the articles thereon through said wash chamber, and means at the entering end of said housing for engaging an article on said conveyor extending laterally beyond said conveyor to force said article laterally inwardly for proper passage through said housing, said fingers being inclined rearwardly at a sliding angle with relation to the path of travel of said conveyor to effect upward camming motion thereon of said laterally projecting article upon contact between said article and said engaging means on said housing for release of said fingers and continuance of said forward travel of said conveyor.

19. In a dishwasher of the character described having a wash chamber adapted to contain means for discharging wash and rinse sprays therein, the combination of a plurality of links and a plurality of cross members secured together in spaced relation forming a continuous conveyor of substantial width movable through said chamber past said sprays and having an essentially open construction for free passage of said sprays therethrough, means forming a plurality of spaced fingers extending upwardly from said conveyor, means on said conveyor maintaining said fingers in spaced and aligned relation both laterally and longitudinally of said conveyor to cooperate in defining a plurality of dish receiving recesses arranged both laterally and longitudinally of said conveyor, and means on said conveyor below said fingers for supporting said dishes out of contact with said cross members and cooperating with said fingers to maintain said dishes in generally upright position for free access thereto by said sprays directed through said conveyor.

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April 9, 1929. J. W. BELL ET AL 1,708,253

METHOD OF CLEANING AND PRECOOLING VEGETABLES FOR SHIPMENT

Filed April 24, 1925 3 Sheets-Sheet 1

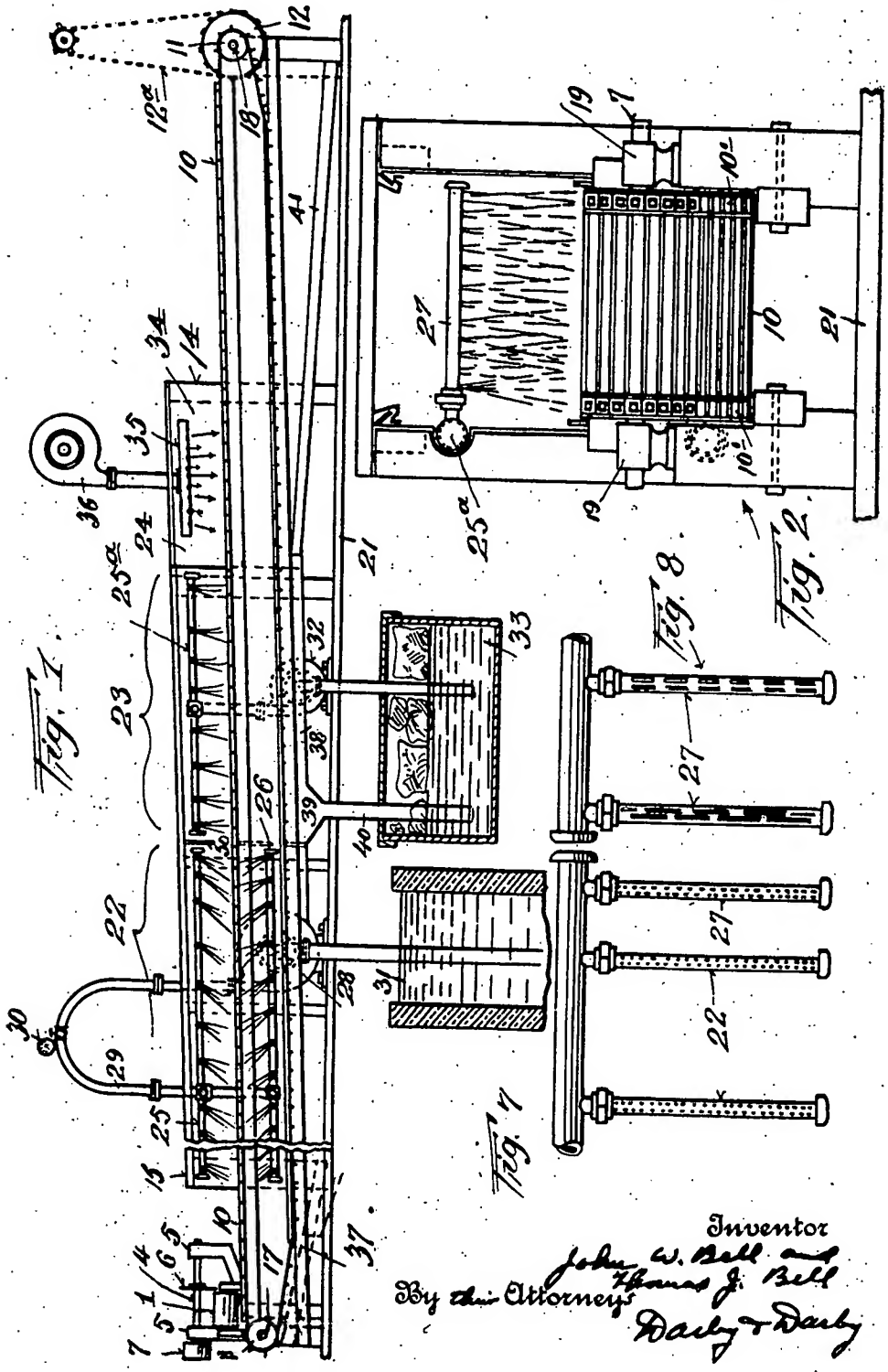

Fig. 1.

Fig. 2.

Fig. 8.

Fig. 7.

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METHOD OF CLEANING AND PRECOOLING VEGETABLES FOR SHIPMENT

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Fig. 3.

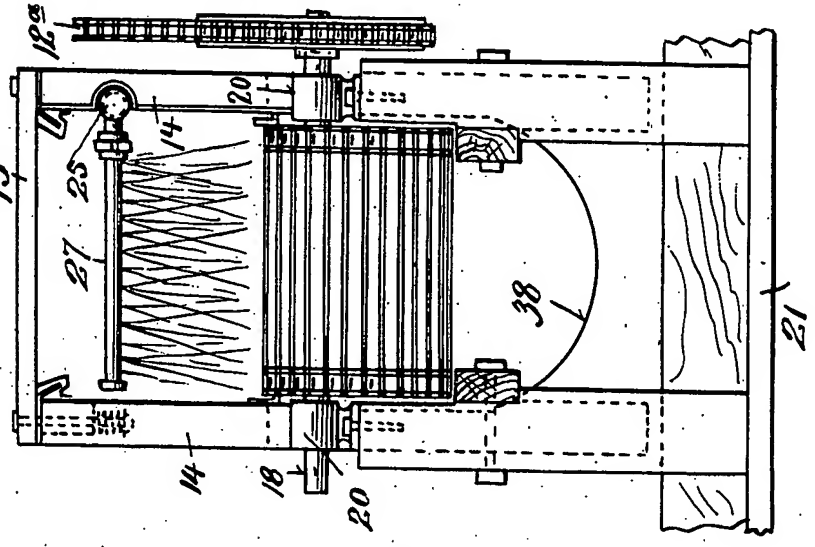


Fig. 6.

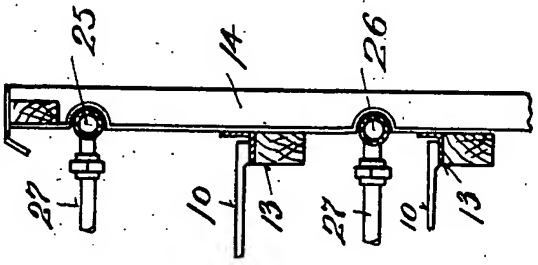


Fig. 5.

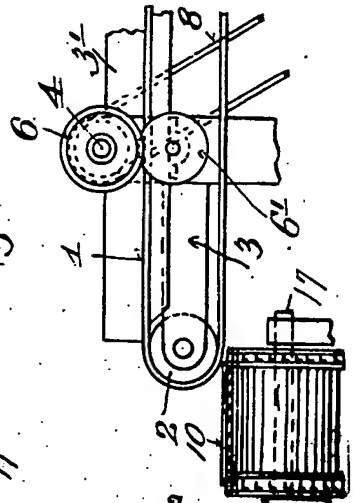
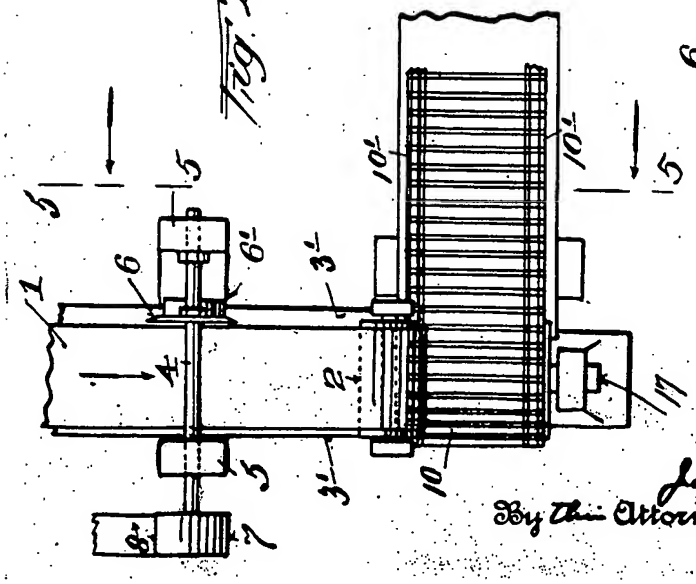


Fig. 4.



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METHOD OF CLEANING AND PRECOOLING VEGETABLES FOR SHIPMENT

Filed April 24, 1925 3 Sheets-Sheet 3

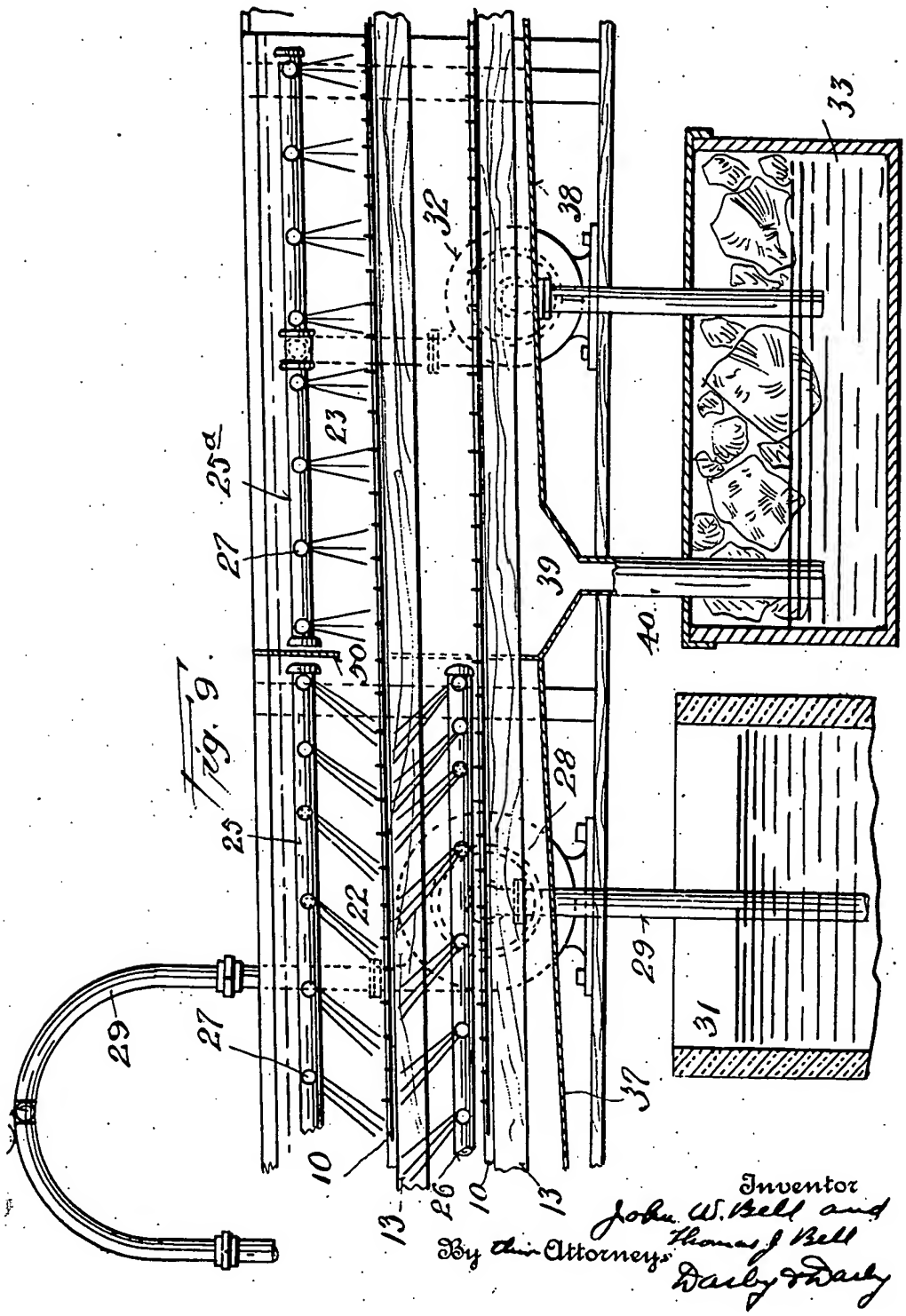

Fig. 9.

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Patented Apr. 9, 1929. 1,708,253

UNITED STATES PATENT OFFICE.

JOHN W. BELL AND THOMAS J. BELL, OF LAKE MONROE, FLORIDA.

METHOD OF CLEANING AND PRECOOLING VEGETABLES FOR SHIPMENT.

Application filed April 24, 1925. Serial No. 25,575.

This invention relates to a method of preparing vegetables prior to packing the same for shipment.

The object of the invention is to provide a method and apparatus which is simple and efficient for cleaning and precooling vegetables, such as celery, peppers, and others, so as to remove therefrom fibrous roots, adhering soil or superfluous leaves or other undesirable matter, and at the same time to precool and prepare the vegetables so that they will be better preserved during shipment and be ready for use upon reaching the market.

Another object of the invention is to provide a method of the nature and character referred to, which is economical and efficient in operation and by which the vegetables named can be effectively prepared for packing and shipping.

A further object of the invention is to provide a continuous process for the removal of any excess moisture in the vegetable which might be present due to the cleaning and precooling of the same.

Further objects of the invention will appear more fully hereinafter.

The invention consists substantially in the steps set forth and is capable of being carried out by our apparatus herein described.

Referring to the accompanying drawings and to the various views and reference numerals appearing thereon:—

Fig. 1 is a view in side elevation, with the side wall removed, illustrating an arrangement of apparatus constructed in accordance with and carrying out the objects and purposes of our invention.

Fig. 2 is an end view of the apparatus at the feeding end of same, with the cutting portion not shown.

Fig. 3 is an end view of the apparatus at the discharge end of same, the drying unit being eliminated.

Fig. 4 is a broken top plan view of that portion of the apparatus employed for cutting the tops, fibrous roots or the leaves, in part or all, from the vegetables before the same are cleaned and precooled.

Fig. 5 is a view in elevation taken on the line 5—5 of Fig. 4 and looking in the direction of the arrows.

Fig. 6 is a broken detail sectional view in elevation of one of the side walls of the apparatus, showing the arrangement of the several parts with respect thereto.

Fig. 7 is a broken detail view showing the construction of one form of spray used in the apparatus.

Fig. 8 is a similar view showing alternative form of spray nozzles.

Fig. 9 is an enlarged broken sectional view of Fig. 1, showing a portion of the cleaning and precooling parts of the apparatus.

The same part is designated by the same reference numeral wherever it occurs throughout the several views.

While we have shown and now will describe our invention of a method and apparatus as particularly adapted for use in cutting, cleaning and precooling celery, we do not desire to be limited or restricted in this respect as the features of this invention may readily be utilized for the same purposes in connection with other vegetables, fruits and the like.

In packing celery for shipment, the usual practice is to bring the same in from the field, give each bunch of stalks a superficial washing by dousing the same in water and then pack a number of bunches in a crate. The crate, after being packed, is then passed through a precooling apparatus which is adapted to direct sprays of iced water on the crate to cool the celery so that it will not spoil during shipment. Quite frequently the celery is packed in crates without the above mentioned preliminary washing and the crate is then subjected to the precooling operation, as above described.

Celery packed and shipped in the manner above described quite frequently spoils during transit, due to insects, dirt and other matter left between the stalks, or because the precooling of the celery after it is packed in the crate fails to sufficiently precool the stalks.

Even if the celery packed and shipped in this manner does reach its destination in good condition, the dealer receiving the same has to thoroughly wash it before he can put it on sale. This additional labor and handling tends to increase the cost of the celery to the consumer. It also decreases the profit to the shipper, and is one of the chief causes of deterioration in flavor.

It is among the special purposes of our present invention to so prepare the celery before shipment that it will be thoroughly cleaned, precooled and have less tendency to spoil during transit, and the necessity of additional handling by the dealer receiving the same will be eliminated.

It is also among the special purposes of our

invention to provide a method and apparatus for accomplishing these results in a simple, economical and practical manner.

We have developed a most efficient method of treating green vegetables for preparing them for market so as to present most attractive appearances and retain their natural flavor. The method comprises subjecting the green vegetables in a continuous path or succession to preliminary cleaning and trimming steps to remove superfluous vegetation and adhering foreign matter, then causing the precleaned vegetables to travel in a substantially straight line and while so traveling causing jets of water to be impinged tangentially against said traveling vegetables from various directions, thereafter causing said vegetables to be cooled and dried while continuing their course of travel, and finally wrapping the prepared vegetables and crating the same. When the method is applied to celery the individual bunches are subjected to the precleaning and trimming steps and then the precleaned and trimmed bunches are subjected to the washing, the cooling and the drying steps in succession as a continuous mode of operation. Celery thus treated is clean and attractive, and because of the proper treatment retains its flavor to a remarkable degree.

The method just described is capable of being performed by various instrumentalities, and we will now describe one form of apparatus which is designed to carry out our improved process.

The apparatus for carrying out our invention will be considered under four headings: (1) the trimming and preliminary cleaning or precleaning unit; (2) the washing or cleaning portion of the machine; (3) the precooling part; and (4) the drying mechanism.

That part of the apparatus coming under the first heading is best shown by Figs. 4 and 5, and comprises an endless conveyor 1 which is actuated by a suitable driving mechanism (not shown). This conveyor is an endless belt, or the like, which is appropriately supported near its delivery end by an idler 2 which, in turn, is supported in a frame 3. This frame is secured to the side walls 3′, 3′. A drive shaft 4 supported in bearings 5, 5, is provided with a drive pulley 7 for operating the cutter disk 6 to remove superfluous and foreign matter and to trim the tops or root fibres of such vegetables as celery, beets, carrots and the like. The cutting is accomplished by reason of the cutting disk rotating over the surface of the idler 6′ and thus trimming the vegetables as they are carried past by the conveyor 1. The trimmer may obviously be placed on either side of the conveyor, and where the trimmer is used for removing the rootlets, as in celery, it also removes foreign matter, as adhering soil. Vegetables thus trimmed are moved sidewise and delivered on to conveyor 10 of the washing and cleaning portion of the apparatus. This conveyor preferably runs at right angles to conveyor 1 to thereby expose the top ends first to the direct jets of water. Conveyor 10 is a continuous band of spaced slats carried by chains 10′ over the idler 11 at one end of the apparatus and over the drive sprocket 12 at the other. The sprocket is driven by a chain 12ª from any suitable source to drive the conveyor 10. This conveyor is further supported by guide rails 13, 13, on both sides of the enclosing side walls 14, 14. These walls are provided with a cover 15 to form a casing for the washing, cooling and drying portions of the apparatus, through which the vegetables are conveyed for the purpose stated. It will be noted that the drive sprocket 12 is placed somewhat higher than sprocket 11 so that the conveyor 10 will carry the vegetables up an incline through the cleaning, precooling and drying portions of the apparatus. Sprockets 11 and 12 are supported by shafts 17 and 18 in bearings 19 and 20, as is best shown in Figs. 1 and 3.

The second portion of the apparatus, or the washing and cleaning part, is broadly designated by the numeral 22 (Figs. 1 and 9). This portion of the apparatus comprises a chamber wherein the water supplying pipes 25 and 26 extend longitudinally thereof supported by seats in the wall 14. Pipe 25 is placed above the upper portion of conveyor 10 and pipe 26 is placed below said portion. Both pipes are provided with lateral branch or spray pipes 27 extending therefrom at right angles. These pipes are provided with a number of holes, as shown in Fig. 7, or with slits, as shown by Fig. 8, through which water is forced at appropriate pressure and as is indicated by a gauge 30. Water is derived from any source of supply 31, by means of a pump 28 taking in water through pipe 29, and forcing it out through the openings in the spray pipes 27. For the most effective arrangement, we cause the jets to be directed tangentially on to the moving celery or vegetables from opposite directions.

The precooling portion of the apparatus is generally designated by the numeral 23 (Figs. 1 and 9). This part includes the continuous chamber of the washing portion from which, however, it is separated partially by a partition 50. A water supplying pipe 25ª is arranged above the conveyor 10 and its branch pipe 27 provides means for spraying ice water on to the vegetables and properly lowering their temperature. For this purpose we provide a pump 32 which conveys the ice water from a source of supply 33 to the distributing pipes.

The cooled vegetables now pass into the drying portion of the apparatus to be relieved of superfluous water prior to packing.

The cooling portion of the apparatus consists of the chamber 34 having arranged therein a distributer pipe 35 to which cool, dry air is supplied by a blower 36. In the preferred form, air is directed on to the moving vegetables from above, as shown in Fig. 1, but the position of the distributer pipe or the number thereof is capable of being varied without departing from the spirit and scope of our invention.

The lower portion of the washing and cleaning unit 22 is provided with a drain pan 37 which is inclined at an angle so that the water which is sprayed on the conveyor as it passes through this portion of the unit will be caught therein and directed to any suitable discharge opening.

The lower portion of the precooling unit chamber 23 has a similar drain pan 38 which is arranged so that the iced water discharged from pipes 25ª and 27 will be directed towards a discharge opening 39 which is arranged to return the water to the supply source 33 by means of a pipe 40.

A similar drain pan 41 is provided at the discharge end of the apparatus and is adapted to carry off any water which might drip from the vegetables after having left the washing and precooling parts of the apparatus. A frame 21 properly supports the parts of the apparatus.

From the description thus far given, the operation of our apparatus will be readily understood and is about as follows, assuming the celery is the vegetable to be prepared for packing:—

The bunches of celery are placed transversely on the conveyor 1 so that the portions of the tops to be removed will be carried in the path of the cutter 6 to be there removed, together with adhering soil. The precleaned bunches are then delivered on to conveyor 10 and now travel endwise against the sprays of water which are forcibly applied from above and below to thus thoroughly wash off all undesirable matter, insects and the like, so as to leave the bunches in condition fit for use or market.

The next stage is the precooling. This is accomplished as the celery passes through the precooler which is kept at lowered temperature by iced water. If desired, of course the cooling might be effected by properly chilled air similar to the cooled drying which takes place in the drying portion of the apparatus. As the celery passes through the drying station superfluous water is removed and the cleansed, cooled stalks or bunches are ready for shipping. Celery thus treated retains its texture and flavor far better and presents a far more attractive appearance than does celery treated by the old methods.

To properly protect the cleaned and crisp celery, we wrap each bunch in a covering of paper or the like and then pack them in crates for shipment.

From the foregoing, it will be seen that we provide an exceedingly simple and efficient apparatus and mode of operation for cleaning and precooling celery and other vegetables prior to shipment.

Having now described our invention, what we claim as new and useful, of our own invention, and desire to secure by Letters Patent, is:

1. That method of preparing vegetables, which comprises subjecting the vegetables to be prepared in a continuous path to a preliminary cleansing for the removal of superfluous vegetation and adhering foreign matter, then submitting said vegetables to impinging jets of wash-water applied in opposition to the path of travel of said succession of vegetables, then cooling said vegetables and removing excess of moisture.

2. That method of preparing and packing celery for shipment, which comprises subjecting individual celery bunches in succession to a trimming of loose leaves and fibrous roots, then moving said trimmed celery bunches through jets of wash-water impinged tangentially onto said succession of celery bunches traveling in opposition to said impinging wash-water, then submitting said trimmed and washed celery bunches to a sudden drop in temperature for cooling the same, and finally removing excess of moisture from said celery bunches for packing and shipping.

3. The method of treating celery, which comprises subjecting said celery to a cleaning action to remove excess vegetation and foreign matter, then causing said celery to travel against stream of flowing wash-water to thereby remove the last traces of earth and other foreign matter, then subjecting said clean celery to a cooling medium, and finally removing excess of moisture from said cleaned and cooled celery.

In testimony whereof we have hereunto set our hands on this 16th day of April, A. D. 1925.

JOHN W. BELL.
THOMAS J. BELL.

Jan. 19, 1954 R. B. CROSSET 2,666,711

METHOD AND APPARATUS FOR PROCESSING LEAFY VEGETABLES

Filed Sept. 20, 1951 2 Sheets-Sheet 2

FIG-2

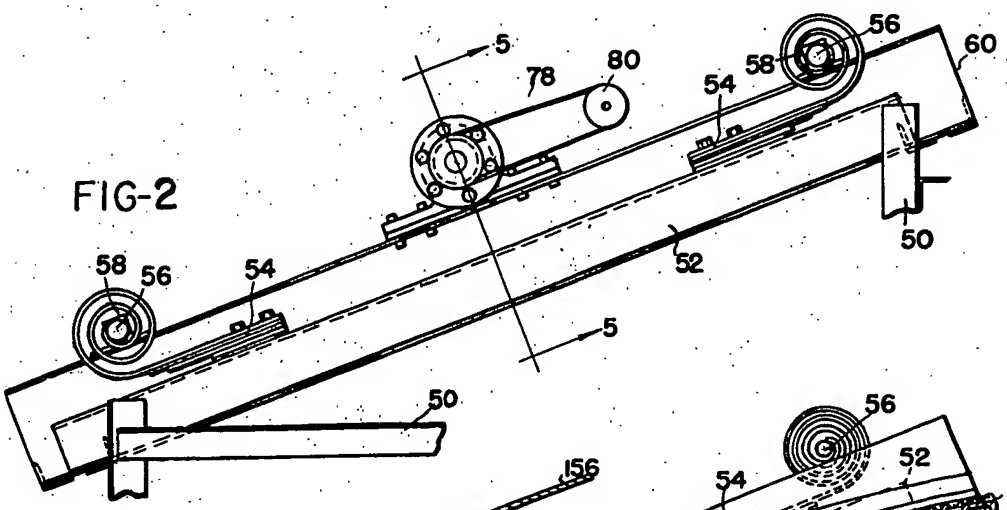


FIG-3

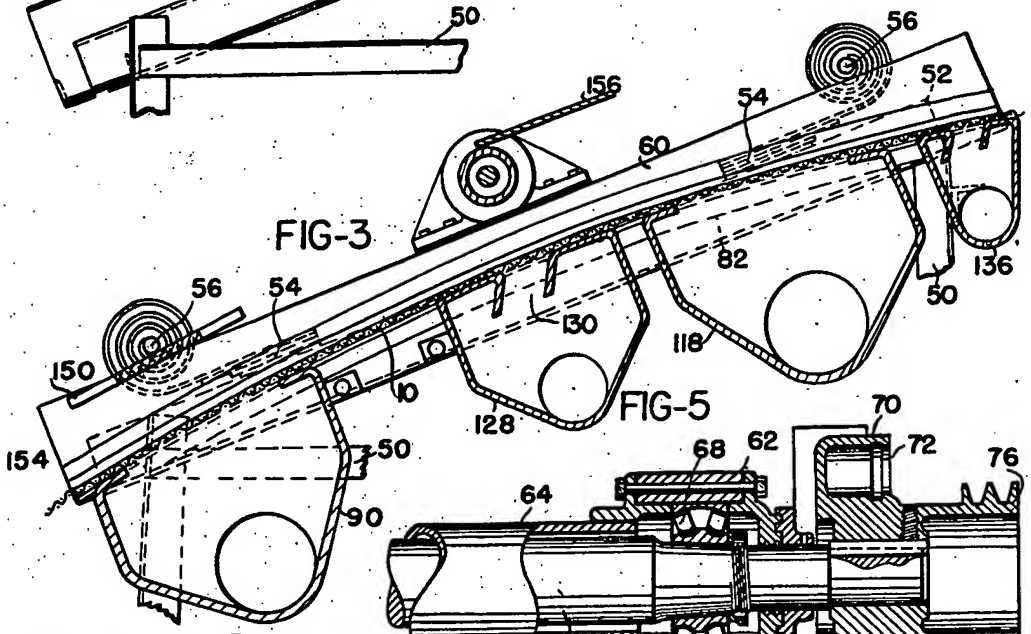


FIG-5

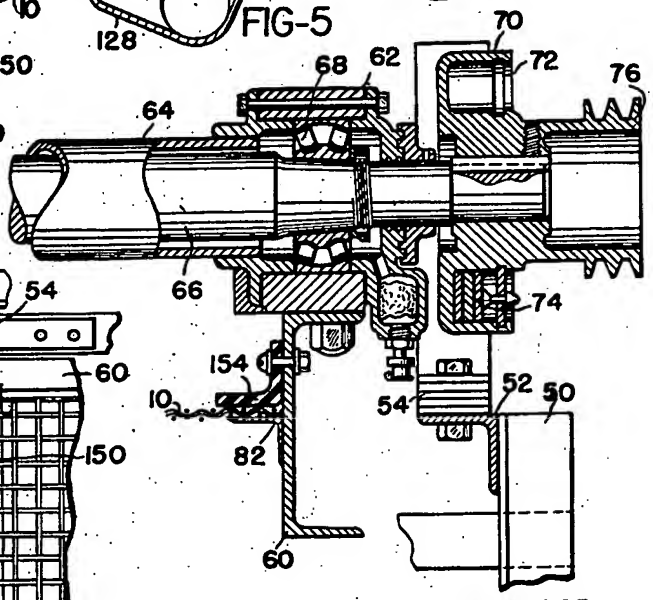
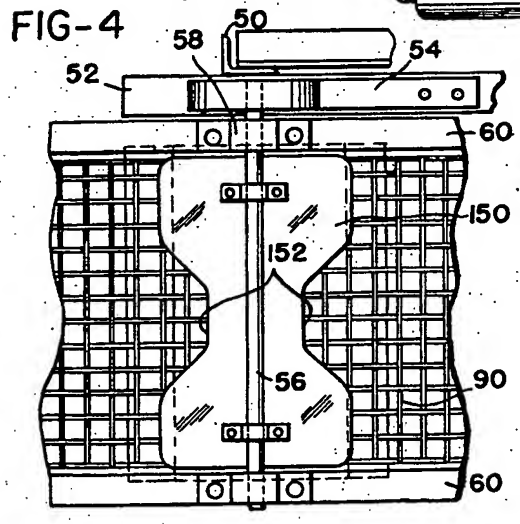


FIG-4



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Patented Jan. 19, 1954 2,666,711

UNITED STATES PATENT OFFICE

2,666,711

METHOD AND APPARATUS FOR PROCESSING LEAFY VEGETABLES

Richard B. Crosset, Cincinnati, Ohio, assignor to The Crosset Company, Cincinnati, Ohio, a partnership

Application September 20, 1951, Serial No. 247,531

19 Claims. (Cl. 99—204)

1

This invention relates to washing and drying devices for leafy vegetables, such as spinach, kale and the like, and to a method of operation of the device, particularly as regards the drying operation.

In the commercial processing of vegetables of the nature referred to, large volumes are handled and it is essential that vegetables be handled rapidly and efficiently in order to get them to markets at the proper time and in good condition. With spinach and kale, it is absolutely essential that they be properly washed so as to be clean when they are offered for purchase. This washing is done with water, and after the washing has been completed, the washed vegetables must be dried to a predetermined degree before being packaged or shipped to their point of sale.

Particularly with spinach, the washing and drying has always been difficult to carry out properly because heretofore it has been the practice to wash the spinach leaves and then to dry them in batches in centrifuges. The degree of drying desired can, of course, be accomplished in a centrifuge, but the leaves will vary widely in texture, hardness, and moisture content and it is difficult to process through a centrifuge without breaking or bruising, and as a result, centrifugally dried leaves are characterized in not being of as good a quality as desired.

With spinach, especially, when it is grown under conditions of warmth and adequate moisture, the leaves are quite delicate and are easily crushed or cracked, and at these points of injury, the leaf will bleed and present a very poor appearance, as well as creating a point where deterioration can commence.

When the spinach is grown under rather cold conditions, the leaves have a tendency to be quite hard and brittle, and while this does not detract in the value as a food, it makes the leaves quite easy to break, and with this type of growth an unusual amount of damage occurs to the leaves during their centrifuging.

Having the foregoing in mind, the present invention has, as the primary object, the provision of a method and apparatus for washing and drying leafy vegetables, such as spinach and kale, wherein the difficulties referred to above are avoided.

Another object is the provision of such a method and apparatus which will be extremely rapid in operation, thereby permitting large volumes of the vegetables to be processed.

A particular object is the provision of a method and apparatus of the nature described, characterized in that it is continuous in operation as opposed to former batch processes.

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Still another particular object is the provision of a method and apparatus for drying leafy vegetables such as spinach and the like, which is rapid in operation, reduces the amount of moisture carried by the leaves to the desired amount and does not damage the leaves.

In general, the objects of this invention are attained by first washing the spinach by jets of water, and by submersion in water, then draining the loose moisture from the leaves, and then extracting the other moisture it is desired to remove by a combination of vibrations of the leaves and the application of a moving air stream.

According to the present invention, the vibration of the leaves is accomplished by vibrating a conveyor belt on which they are distributed while the air stream is created by applying a suction to the side of the conveyor belt opposite to that on which the leaves are placed, the said belt being perforated.

Damage is avoided by turning the leaves over on the conveyor by an air stream so that both sides of the leaves are subjected to the combination of vibrations and suction.

The several objects and advantages enumerated above, as well as other objects and advantages of this invention, will be more clearly understood upon reference to the following specification taken in connection with the accompanying drawings in which:

Figure 1 is a schematic view showing the arrangement of a washing and drying device according to my invention;

Figure 2 is a side elevational view of the vibrating and drying section of the machine;

Figure 3 is a longitudinal section through the vibrating and drying section;

Figure 4 is a plan view looking down on top of the conveyor at one of the suction heads of the vibrating and drying section, as represented by arrow 4 on Figures 2 and 3;

Figure 5 is a vertical section indicated by line 5—5 on Figure 2, showing the arrangement of the driven shaft by means of which the vibrator and drier are vibrated;

Figure 6 is a fragmentary sectional view of an intermediate point in the drier and vibrator section, showing the manner in which the leaves being treated are turned over.

In referring to the drawings in more detail, the arrangement shown in Figure 1 comprises a perforated conveyor belt 10, which may be, for exam-

ple, a relatively open mesh wire screen through which air and water can freely pass, but also, the mesh is of such a size that the leaves will be adequately supported. Conveyor belt 10 moves in the direction of the arrow in Figure 1 and first conveys leaves distributed thereon through a chamber 12, comprising a plurality of jets of water 14 directed both upwardly and downwardly so as to spray both sides of the leaves. This station removes most of the loose and heavy soil carried by the leaves, and the water falling from the conveyor belt is drained by means of the sump 16.

From chamber 12, the conveyor belt passes to another washing chamber 18, wherein the conveyor belt is depressed by suitable idler rollers engaging the edge thereof so that it passes beneath the surface of the liquid in a tray 20. Within tray 20 are arranged both downwardly and upwardly acting water jets 22, and these water jets serve to remove further soil while the leaves are thoroughly soaked in the water, and thus, further soil, such as dry, hard earth is removed therefrom. The overflow from tray 20 falls into a sump 24, which has a compartment 26 at one end of it separated from the main part of the sump by the screen partition 28. Compartment 26 serves as a reservoir for supplying washing water to jets 14 and 22 by means of the pump 30. In this manner an economy of water is accomplished which materially reduces the cost of thoroughly washing the leaves.

After leaving station 18, the conveyor belt passes through a final washing station 32, and at which fresh, clean water is supplied through a supply pipe 34 leading to the upwardly and downwardly acting jets 36. The water which drains from the conveyor belt at this station is directed by drain board 38 to the sump 24.

After leaving station 32, the conveyor belt passes along a draining section indicated by the break at 40 in Figure 1, and during this travel a good deal of the moisture entrained on the leaves drains therefrom.

After a predetermined amount of travel, the conveyor belt enters a vibrating and drying section, generally indicated at 42, and wherein the conveyor belt is vibrated rapidly while at the same time a suction is applied to the underneath side of the conveyor belt which serves to remove the moisture which is displaced from the leaves by the vibration.

After leaving the vibrator and drying section, the leaves, which are now ready for sorting and packaging, are delivered to another conveyor belt or the like where the bad and defective leaves are removed and the leaves which are suitable for use are packaged or otherwise packed.

Referring now to the vibrating and drying section, this will best be seen in Figures 1 through 5, wherein it will be noted that there is provided a stationary frame 50 including a longitudinally extending angle 52. Adjacent each end of stationary angle 52 there is mounted a leaf spring 54 and extending between corresponding ones of these springs 54 in opposite sides of the frame 50 are the shafts 56. Shafts 56 are mounted in bearings or other suitable supports 58 that are rigidly mounted on the longitudinally extending channel members 60 that form the side members for the movable portion of the vibrator and drier section. These same members are suitably interconnected by transversely extending structural elements so as to make a rigid frame while at the same time leaving the frame open for the passage of the conveyor belt 10.

The vibration of the entire frame is accomplished by a vibrating device mounted on side members 60 at the center of the frame. This vibrator device comprises a pair of bearing brackets 62 mounted on channel members 60 and having extending therebetween a tube or sleeve 64 within which there is a shaft 66 journaled to its opposite ends on bearings 68 and said bearing brackets.

At each end of shaft 66 there is mounted a member 70 comprising an annular cavity 72 adapted for receiving weights 74. The weights 74 provide for an off-center mass so that when shaft 66 is driven, it will exert vibratory forces on the frame of the vibrator and drying section, which, due to the resilient support of the section provided by leaf springs 54, will cause the said frame to vibrate.

On one side of the frame, shaft 66 is provided with a pulley means 76, which may be belted by belts 79 with a motor driven pulley 80. By selecting a suitable speed of rotation and suitable support springs, the vibrator section can be made to vibrate at any desired amplitude and at any desired rate. I have found it satisfactory for the vibrator to move with an amplitude upon the order of from $\frac{1}{8}$ to $\frac{3}{8}$ of an inch on each side of its neutral position and at a rate of about 1000 cycles per minute.

The amplitude of vibration referred to above, and the rate of vibration are sufficient to cause water carried by the leaves in the form of little droplets to be shaken therefrom, or to be brought together so as to form larger droplets which will more easily drain from the leaves or more readily be drawn therefrom by an air stream, while at the same time, the leaves do not tend to bounce about on the conveyor belt and are not broken, crushed, or damaged in any other way.

As will be seen in Figures 1 and 3, the conveyor belt extends through the frame of the vibrator and drier section along an arcuate path, and this path is determined by the support angles 82 which are arcuately formed and which are mounted on the inside faces of the side channel members 60 of the vibrator frame. At the discharge end of the vibrator frame, the belt passes over the driven roller 84 and has a relatively long slack loop 86 formed therein engaged between adjustable idler roller 88. Due to the angular arrangement of the vibrator frame, its movement is in the form of a relatively flat orbit, having its major axis inclined upwardly and rightwardly as the frame is viewed in Figures 1 through 3. An unexpected advantageous result is obtained from this arrangement, inasmuch as it was found that the vibratory movement of the frame had a strong tendency to assist in the driving of the conveyor belt, and thus, materially to reduce the power requirements for actuating the conveyor belt. At the same time, no noticeable deterioration of the conveyor belt has occurred, probably due to the fact that the direction of vibration of the vibrator frame is such that it imposes no extreme longitudinal stress on the conveyor belt.

Arranged within the vibrator frame and engaging the underneath surface of the conveyor belt are a plurality of nozzles forming the means for withdrawing water from the vegetable leaves and for turning the leaves over on the belt.

At the left end of the vibrator frame, as it is viewed in the drawings, there is a nozzle 90 having an opening of substantial size immediately beneath the conveyor belt. This nozzle extends the width of the conveyor belt, as will be seen

in Figure 4, and is connected by a conduit 92 through a flexible section 94 with a separator unit 96. Flexible section 94 is positioned relatively close to the vibrator frame and may consist of a fairly short length of rubber or other resilient and air-tight material, and provides the means whereby the nozzle 90 can be securely mounted in the vibrator frame to move therewith while the separator 96 is stationarily mounted on the floor adjacent the machine.

Separator unit 96 comprises an outer tank or inclosure having a baffle 98 therein and including a discharge conduit 100 on the side of the baffle opposite the side onto which conduit 92 opens. The bottom of the separator unit has a discharge pipe 102 normally closed by a pivoted gate 104, and a stand pipe 106 open to the atmosphere. The arrangement is such that the suction applied to conduit 100 will cause air to be drawn through the conveyor belt into nozzle 90 and then through conduit 92 into the separator unit and then around underneath the lower end of the baffle 98. By this arrangement most of the moisture entrained in the air in particle form is separated from the air by the separator unit, as well as the larger particles of the leaves and other particles of soil that may be drawn from the leaves. The provision of the stand pipe insures that there will be an adequate seal between the conduit 100 and the outside atmosphere so that the suction at nozzle 90 will not be broken. The separator unit can be cleaned at any time merely by opening door 104 and flushing out the interior of the unit.

Conduit 100 leads tangentially into the interior of a larger separator unit 108 through opening 110, which arrangement operates to cause the air drawn therein to move in a circular path and at high speed, whereby the air is made substantially dry and is entirely free from any particles of leaves or other material carried thereby. The suction side of blower 112 connects to the separator along the central axis to draw the air therefrom. A drain connection at 114 is supplied for draining separator 108, and the said separator may also include baffle means as at 116 which operate to prevent the water that accumulates in the separator from spinning about and thereby exposing the drain opening to the suction created within the separator. Connection 114 leads to drain via standpipe 115 having overflow 117 bypassing normally closed valve 119. The standpipe provides a fluid seal between the atmosphere and the suction of blower 112 and valve 119 can be opened to flush out the separator when necessary.

Returning now to the vibrator section, there is arranged at the opposite end thereof from nozzle 90, a similar nozzle 118 connected through a conduit 120 that includes a flexible section 122 with a separator unit 124 and which also has a connection as by conduit 126 with the conduit 100 leading to separator 108.

Intermediate nozzles 90 and 118 is an additional nozzle 128 characterized in having an angularly directed nozzle opening 130, and which is a pressure nozzle rather than a suction nozzle. Air may be supplied to pressure nozzle 128 as by a blower 132 discharging through a flexible connection 134.

At the extreme right end of the vibrator section there is a nozzle 136 also supplied by blower 132 and which is operable for blowing the leaves off the conveyor belt on to another conveyor belt or some suitable receiver from which the leaves are taken to the sorting and packaging station.

It has been found that with the rate of vibration of the vibrator frame referred to, a suction at nozzles 90 and 118 on the order of from six to twelve inches of water produces the best results. For the treatment of kale, the lower suction is the better, while for spinach, the higher suction is generally employed, with an eight-inch suction representing a good average rate. With suction on the order referred to, there is a considerable amount of air drawn into the nozzle and with nozzle 90 at the inclined entrance end of the vibrator section, this suction creates sufficient movement of air that it has a tendency to prevent the leaves from moving into the vibrator section. This comes about because of the movement of air upwardly through the conveyor belt on its approach to the vibrator section.

By extensive tests and experimentation, however, I have discovered that by applying a suitable baffle above the nozzle 90, the air-flow into the nozzle can be so directed so as not only to permit the leaves to move up the inclined approach to the vibrator section, but actually to be distributed uniformly over the conveyor belt whereby the best moisture removing conditions obtain.

Such a baffle is illustrated in Figures 1, 3 and 4 and comprises a member 150 generally centrally located over the nozzle opening at a distance therefrom and having cut-outs as at 152 along its opposite edges. This baffle is so adjusted that as the vegetable leaves approach the drier section at predetermined points, they are actually lifted from the conveyor belt and conveyed by the air to a point over the nozzle opening and at which point they are deposited again on the conveyor belt. Inasmuch as the air has a tendency to pass through the conveyor belt at exposed portions thereof, this action has a tendency to distribute the leaves uniformly over the conveyor belt and the disposition of the leaves by this arrangement is much more rapid and more uniform than could be obtained by any other mechanical or manual arrangement.

With the leaves so positioned on the conveyor belt over the nozzle 90, the vibration of the conveyor belt will dislodge water therefrom in the described manner, and this water will be taken up by the air stream flowing into the nozzle.

The edge of the conveyor belt as it passes through the vibrator frame can advantageously be sealed by the rubberlike stripping 154, which prevents loss of air about the edge of the conveyor belt.

After the leaves have passed beyond the influence of suction nozzle 90, it is desired to turn them over on the conveyor belt for the drying of the other side. This is accomplished by the angularly directed nozzle 130 which functions in the manner represented in Figure 6. As the leaves, indicated by letter L, approach nozzle 130, they are lifted up by the air stream issuing therefrom and then turned over and are again disposed on the conveyor belt in a perfectly uniform pattern. I have found it advantageous to provide a baffle member 156 mounted above nozzle 130 and which so deflects the air stream therefrom that the picking up and turning over of the leaves is substantially a positive and precise operation with the leaves being inverted and falling onto the conveyor in as uniform a pattern as they had when they passed over suction nozzle 90.

The leaves are then blown from the end of the conveyor by nozzle 136 and are in a condition of uniform dryness of the desired degree on both sides and are ready for sorting and packaging. The leaves are characterized by very little breakage and very little crushing, and are thus in prime condition for obtaining the best prices on the market and for giving the consumer the best possible produce.

It will be noted that the operation of the apparatus according to this invention, is continuous as to all phases and that it is only necessary to supply the leaves to be treated at the proper rate to the receiving end of the conveyor and to receive the washed leaves from the discharge end of the conveyor.

Suitable valve means are, of course, provided for regulating the pressures of the various water jets and the pressures and suctions associated with the various nozzles in drier section. These valves may take any suitable form and are diagrammatically illustrated in the drawings.

It will be understood that this invention is susceptible to modification in order to adapt it to different usages and conditions and, accordingly, it is desired to comprehend such modifications within this invention as may fall within the scope of the appended claims.

I claim:

1. In an apparatus for washing and drying leafy vegetables, a perforated conveyor belt, means for feeding leafy vegetables to said belt, a washing station through which the conveyor belt passes for removing soil from said leafy vegetables, a frame beyond the washing station engaging the edges of said conveyor belt, a pair of suction nozzles engaging the underneath side of said belt within said frame for retaining and drying the moisture on the leafy vegetables while being carried by said belt, means resiliently supporting said frame, means for oscillating said frame whereby the leafy vegetables are continuously shaken, said suction nozzles being spaced apart, and a pressure nozzle communicating with the underneath side of said conveyor belt between said suction nozzles and directing air upwardly through said belt onto said leafy vegetables as they pass thereover.

2. In an apparatus for washing and drying leafy vegetables, a perforated conveyor belt and means for feeding leafy vegetables to said belt, a washing station through which the conveyor belt passes for cleaning said leafy vegetables, a frame beyond the washing station engaging the edges of said conveyor belt, a pair of suction nozzles engaging the underneath side of said belt within said frame for retaining the leafy vegetables on said belt and for removing moisture from said leafy vegetables, means resiliently supporting said frame, means for vibrating said frame for shaking water from said leafy vegetables, said suction nozzles being spaced apart, a pressure nozzle communicating with the underneath side of said conveyor belt between said suction nozzles for blowing air upwardly against said leafy vegetables, blower means connected with said nozzles, and flexible connections disposed between the blower means and the nozzles for permitting vibration of the nozzles with the frame.

3. In a drier arrangement for vegetable leaves; a perforated conveyor belt, suction nozzles communicating with the underneath side of the conveyor belt at spaced points therealong, and a pressure nozzle communicating with the underneath side of the conveyor belt at a point between

said suction nozzles, said pressure nozzle being angularly directed relative to and in the direction of movement of said conveyor belt for turning over on the belt the articles being conveyer thereby, a baffle disposed over the said pressure nozzle for controlling the air flow therefrom, thereby to limit the movement of the articles being turned over by the air stream from the pressure nozzle said baffle and pressure nozzle lying on opposite sides of said belt, said nozzles and the conveyor belt extending thereover being supported in a vibratory frame and means for vibrating said frame.

4. A drier section for a washing and drying apparatus for leafy vegetables comprising; an inclined frame; a perforated conveyor belt extending upwardly at an angle into said frame for conveying leafy articles to be dried therethrough, means for feeding leafy vegetables to said belt means for oscillating said frame to thereby oscillate that portion of the belt and the leafy vegetables thereon passing through said frame, suction nozzles communicating with the underside of said belt and being positioned adjacent the areas of ingress and egress of the belt relative to the frame for drying and retaining said leafy vegetables on said belt, a pressure nozzle communicating with said belt and being positioned intermediate said suction nozzles for blowing air upwardly against said leafy vegetables, baffle plates mounted above said ingress nozzle and said pressure nozzle, said belt lying between said baffles and nozzles so that air flow through said belt will be influenced by the combined action of the nozzle and its corresponding baffle, the air flow from said suction nozzles being directed substantially perpendicular to said belt and the air flow from said pressure nozzle being directed at an angle relative to and in the direction of movement of said belt whereby leafy vegetables on said belt will be turned over under the influence of the air currents created by said pressure nozzle and its associated baffle.

5. A drier section for washing and drying leafy vegetables comprising; a stationary structure, an inclined frame and means for resiliently mounting said frame on said structure, a perforated conveyor belt, means for feeding leafy vegetables to said belt means on said frame for guiding said belt in an arcuate path therethrough, a suction nozzle communicating with the underside of said belt adjacent the place where said belt enters the frame for drying and retaining said leafy vegetables on said belt and a baffle positioned above said nozzle on the opposite side of said belt for controlling air currents whereby to aid in moving said leafy vegetables along with said belt, a pressure nozzle communicating with the underside of said belt substantially midway of said frame for blowing air upwardly against said leafy vegetables and a second baffle positioned above said pressure nozzle on the opposite side of said belt, said suction nozzle being substantially perpendicular to the belt, said pressure nozzle lying at an acute angle relative to said belt and being directed so as to blow air in the direction of movement of said belt whereby said leafy vegetables will be turned over under the influence of the air currents created by said pressure nozzle and its associated baffle.

6. A drier section for washing and drying leafy vegetables comprising; a stationary structure, an inclined frame and means for resiliently mounting said frame on said structure, means

centrally mounted on said frame for oscillating the frame relative to said stationary structure and comprising a rotating shaft having an off-center mass disposed in either end thereof, a perforated conveyor belt, means for feeding leafy vegetables to said belt means on said frame for guiding said belt in an arcuate path therethrough, a suction nozzle communicating with the underside of said belt adjacent the place where said belt enters the frame for retaining and drying said leafy vegetables on the belt as they are oscillated with said frame and a baffle positioned above said nozzle on the opposite side of said belt for creating a component of air flow to assist in moving said leafy vegetables on said belt, a pressure nozzle communicating with the underside of said belt substantially midway of said frame and a second baffle positioned above said pressure nozzle on the opposite side of said belt, said suction nozzle being substantially perpendicular to the belt, said pressure nozzle lying at an acute angle relative to said belt and being directed in the direction of movement of said belt whereby in combination with said second baffle an air blast is created for turning said leafy vegetables over on said belt.

7. A drier section for washing and drying leafy vegetables comprising; an inclined frame, a perforated conveyor belt extending upwardly at an angle into said frame for conveying leafy vegetables to be dried therethrough, means for feeding leafy vegetables to said belt means for oscillating said frame to thereby oscillate that portion of the belt and the leafy vegetables thereon passing through said frame, suction nozzles communicating with the underside of said belt and being positioned adjacent the areas of ingress and egress of the belt relative to the frame for drying said leafy vegetables and retaining them on said belt, a pressure nozzle communicating with said belt and being positioned intermediate said suction nozzles for blowing air upwardly on said leafy vegetables, baffle plates mounted above said ingress nozzle and said pressure nozzle, said belt lying between said baffles and nozzles so that air flow through said belt will be influenced by the combined action of the nozzle and its corresponding baffle, the air flow from said suction nozzles being directed substantially perpendicular to said belt and the air flow from said pressure nozzle being directed at an angle relative to and in the direction of movement of said belt whereby said leafy vegetables will be turned over on said belt, and a second pressure nozzle located adjacent said egress area for blowing the leafy vegetables off said conveyor belt.

8. A method of processing leafy vegetables in a continuous system through washing and drying steps comprising; supporting the leafy vegetables on a perforated conveyor, passing the leafy vegetables on a conveyor through a washing station, subjecting said leafy vegetables in the station to the action of water to remove and dislodge soil therefrom, passing the washed leafy vegetables on the conveyor on through a multi-stage drying section in which the leafy vegetables are continuously subjected to an oscillating vibration, simultaneously with said oscillating alternately subjecting said leafy vegetables to suction and pressure, and discharging the leafy vegetables from the conveyor.

9. A method of processing leafy vegetables in a continuous system through washing and drying steps comprising; supporting the leafy vegetables on a perforated conveyor; passing the leafy vegetables on a conveyor through a washing station, subjecting said leafy vegetables in the station to the action of water to remove and dislodge soil therefrom, passing the washed leafy vegetables on the conveyor on through a multi-stage drying section in which the leafy vegetables are continuously subjected to an oscillating vibration, sucking moisture from the leafy vegetables in a first stage, blowing the leafy vegetables upwardly in a second stage, and again applying suction to the leafy vegetables in a third stage and discharging the leafy vegetables from the conveyor.

10. A method of drying leafy vegetables comprising; arranging the leafy vegetables on a perforated conveyor, moving the leafy vegetables on the conveyor through a drying station and in the direction of the conveyor, imparting a vertical oscillatory force to the leafy vegetables continuously as they pass through the drying station, applying a suction to the underneath side of the leafy vegetables during said oscillatory movement for drying said leafy vegetables and for maintaining their movement along the conveyor.

11. A method of drying leafy vegetables following a washing process comprising; distributing the leafy vegetables on a perforated conveying system, moving the leafy vegetables on the conveyor in the direction of its length, oscillating the conveyor in a direction at an angle to the direction of its length, applying a suction to the underneath side of the oscillating conveyor at spaced points therealong for retaining and drying the leafy vegetables on said conveyor, blowing air upwardly through the conveyor at a point intermediate the said spaced points for turning the leafy vegetables over on the conveyor between the two said points to dry the leafy vegetables on both sides thereof.

12. A method of drying leafy vegetables following a washing process comprising; distributing the leafy vegetables on a perforated conveying system, moving the leafy vegetables on the conveyor in the direction of its length, oscillating the conveyor in a direction at an angle to the direction of its length, applying a suction to the underneath side of the oscillating conveyor at spaced points therealong for retaining and drying the leafy vegetables on said conveyor, blowing air upwardly through the conveyor at a point intermediate the said spaced points for turning the leafy vegetables over on the conveyor between the two said points to dry the leafy vegetables on both sides thereof, the rate of oscillation being on the order of 1000 cycles per minute.

13. A method of drying leafy vegetables following a washing process comprising; distributing the leafy vegetables on a perforated conveying system, moving the leafy vegetables on the conveyor in the direction of its length, oscillating the conveyor in a direction at an angle to the direction of its length, applying a suction to the underneath side of the oscillating conveyor at spaced points therealong for retaining and drying the leafy vegetables on said conveyor, blowing air upwardly through the conveyor between the two said points to dry the leafy vegetables on both sides thereof, the rate of oscillation being on the order of 1000 cycles per minute, and the amplitude of said oscillations being on the order of $\frac{3}{16}$-inch on either side of a neutral position.

14. An apparatus for drying leafy vegetables

comprising; a frame comprising spaced side rails, a stationary structure, means comprising springs mounted at opposite sides and at opposite ends of said frame for resiliently supporting the frame on said structure, a perforated conveyor belt and means for feeding the leafy vegetables to said belt, arcuate guide means for the inner faces of said side members for guiding said perforated conveyor belt and thereby said leafy vegetables through the frame, spaced suction nozzles in the frame for enging the underneath side of the conveyor belt and for drawing moisture from said leafy vegetables, a shaft extending transversely across the frame intermediate the ends thereof and including an off-center weight, and means for driving said shaft thereby causing said frame to oscillate on its resilient support whereby said leafy vegetables are subjected to an oscillatory movement to aid the drying thereof while passing through said frame.

15. An apparatus for drying leafy vegetables comprising; a frame comprising spaced side rails, a stationary structure, means comprising springs mounted at opposite sides and at opposite ends of said frame for resiliently supporting the frame on said structure, a perforated conveyor belt and means for feeding the leafy vegetables to said belt, arcuate guide means for the inner faces of said side members for guiding said perforated conveyor belt and thereby said leafy vegetables through the frame, spaced suction nozzles in the frame for engaging the underneath side of the conveyor belt and for drawing moisture from said leafy vegetables, a shaft extending transversely across the frame intermediate the ends thereof and including an off-center weight, and means for driving said shaft thereby causing said frame to oscillate on its resilient support whereby said leafy vegetables are subjected to an oscillatory movement to aid the drying thereof while passing through said frame, said frame being inclined at an angle whereby said oscillatory movement takes place at an angle extending diagonally to said conveyor belt.

16. In a drier section for drying leafy vegetables; a stationary structure, a frame in the structure comprising spaced side members, means at opposite ends of said side members and at opposite sides of the frame for resiliently supporting the frame on the structure, a perforated conveyor belt and means for feeding leafy vegetables to said belt, arcuate guide means on the inside faces of said side members for engaging the edges of said perforated conveyor belt, said frame being inclined upwardly in the direction of movement of said belt, a suction nozzle at each end of the frame for engaging the underneath side of the conveyor belt and for drawing moisture from and retaining said leafy vegetables on said belt, a pressure nozzle at an intermediate point of the frame engaging the underneath side of the belt for blowing air upwardly on the leafy vegetables, a shaft extending transversely of the frame above said belt at an intermediate point thereon and journalled on the frame, said shaft including off-center masses at its opposite ends, and means for driving said shaft for oscillating said frame whereby said leafy vegetables are subjected to an oscillatory movement while under the influence of said suction and pressure nozzles.

17. In a drier arrangement for leafy vegetables; an inclined frame, a perforated conveyor belt extending upwardly at an angle and into said frame for conveying leafy vegetables to be dried thereto, means for oscillating the frame thereby to oscillate the portion of the conveyor belt carried by the frame and thereby to oscillate said leafy vegetables, a suction nozzle in the frame engaging the underneath side of the conveyor belt adjacent the point where the conveyor belt enters the frame for drawing moisture from said leafy vegetables, and a baffle mounted in the frame and disposed over the said nozzle for attaining a component in the air flow to said nozzle in the direction of movement of the conveyor belt to assist in the movement of the leafy vegetables to be dried into the frame, said belt lying between said baffle and nozzle.

18. In a drier arrangement for leafy vegetables; a perforated conveyor belt, means for feeding leafy vegetables to said belt, suction nozzles communicating with the underneath side of the conveyor belt at spaced points therealong for retaining the leafy vegetables on the belt and for drying thereof, a pressure nozzle communicating with the underneath side of the conveyor belt at a point between said suction nozzles, the air flow from said pressure nozzle being angularly directed relative to the direction of movement of said conveyor belt for turning over on the belt the leafy vegetables being conveyed thereby.

19. In a drier arrangement for drying leafy vegetables; a perforated conveyor belt, means for feeding leafy vegetables to said belt, suction nozzles communicating with the underneath side of the conveyor belt at spaced points therealong for retaining said leafy vegetables on the belt and for drying thereof, a pressure nozzle communicating with the underneath side of the conveyor belt at a point between said suction nozzles, the air flow from said pressure nozzle being angularly directed relative to and in the direction of movement of said conveyor belt for turning over on the belt the leafy vegetables being conveyed thereby, a baffle disposed over the said pressure nozzle for controlling the air flow therefrom, thereby to limit the movement of the articles being turned over by the air stream from the pressure nozzle, said belt lying between said pressure nozzle and baffle.

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Alameda

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[54] **FRESH PRODUCE PACKING ASSEMBLY AND METHOD**

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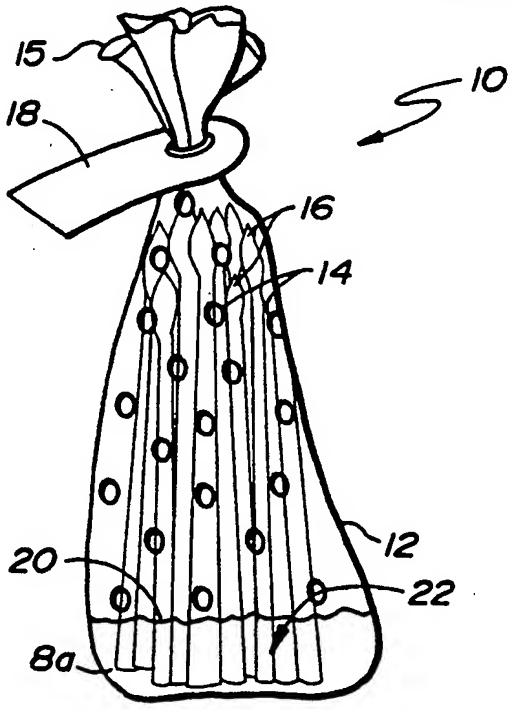
[57] **ABSTRACT**

A fresh produce packing assembly and method for storing and transporting fresh produce. The produce packing assembly includes a hollow container having a liquid collection volume therein defined by a liquid impervious device and a passageway providing for liquid communication between the interior and exterior of the container. Produce pieces are positioned in the container and liquid, usually water, is added to the container for retention in contact with a portion of the produce positioned in the collection volume. The produce packing method includes the steps of placing produce pieces within a package having a liquid collection volume, closing the package to secure the pieces inside, introducing a liquid into the package for accumulation within the collection volume, and draining any liquid exceeding the amount retained by the collection volume from the interior of the container through the passageway.

14 Claims, 3 Drawing Sheets



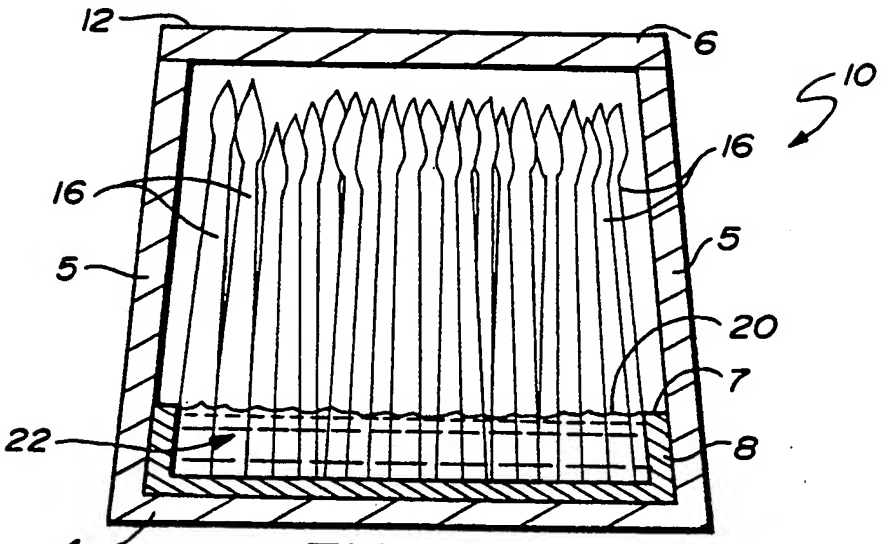
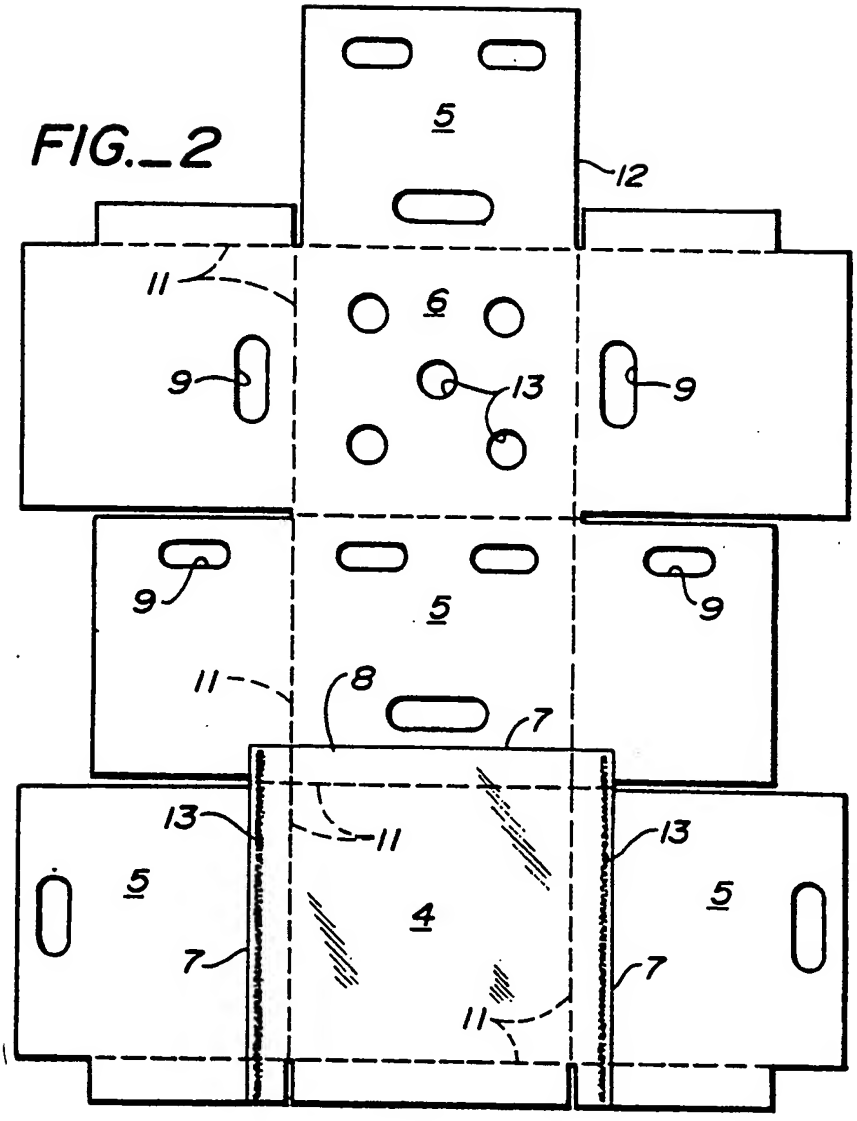
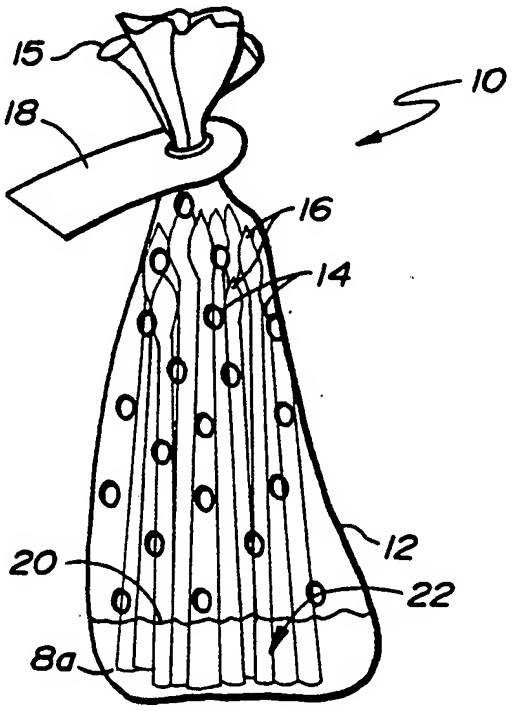


FIG._1

FIG._2

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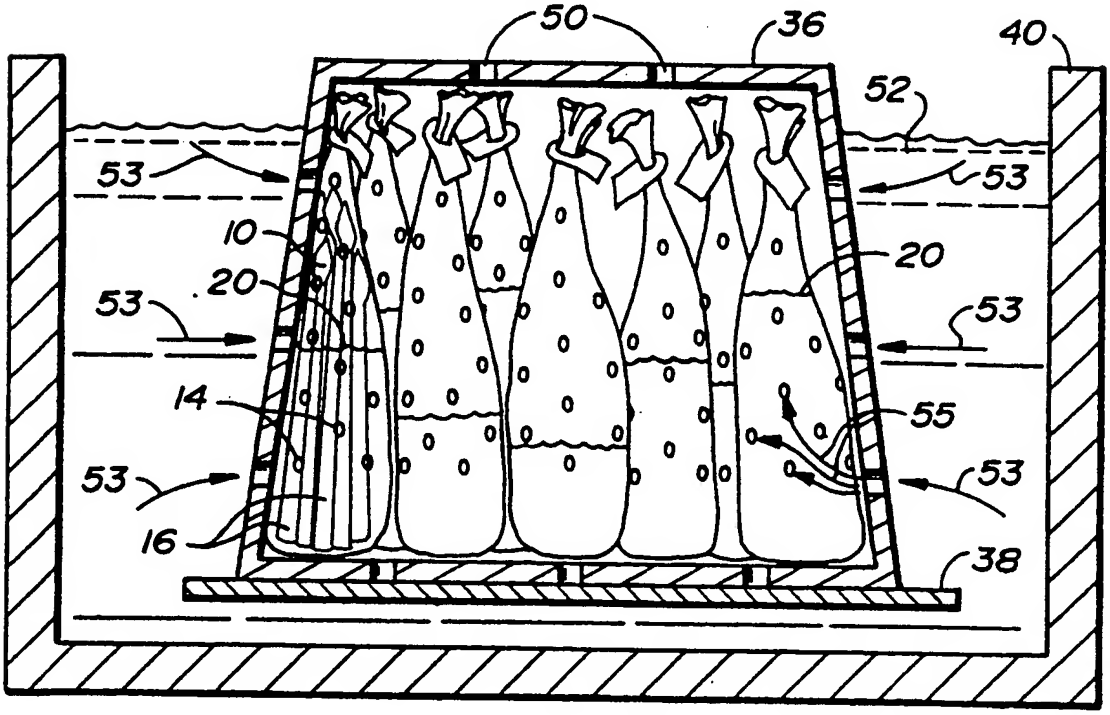
8a

FIG._3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36
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52
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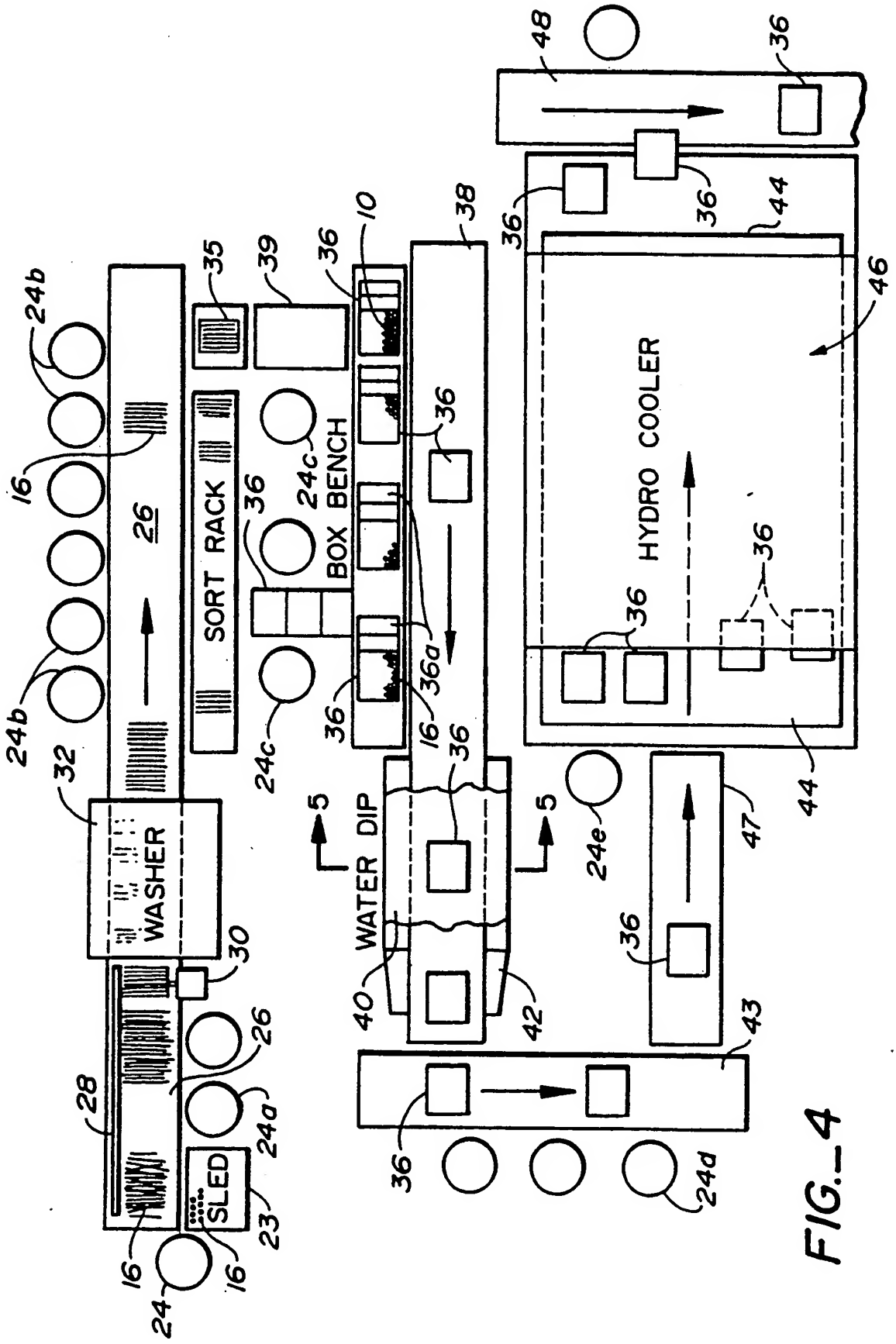
FIG._5


WASHER
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BOX BENCH
WATER DIP
HYDRO COOLER
SLED
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FIG._4

FRESH PRODUCE PACKING ASSEMBLY AND METHOD

TECHNICAL FIELD

In general, the present invention relates to a packing assembly and method for packing fresh produce. More particularly, the present invention relates to a packing assembly and method which may be used for transportation and storage of asparagus.

BACKGROUND ART

The fresh produce which is available to the consumer in the supermarket has been harvested, packed in storage cartons, and shipped from the fields. Unless the consumer resides in or near an agricultural community, the produce found in the supermarket has been shipped from fields which are miles away. Transporting produce grown on the west coast of the United States to the east coast, for example, takes several days, and the produce can arrive in a stressed or poor condition. Because of the long trip, the shelf life is substantially reduced and the produce will be in a marketable condition only for a short time. Thus, the quality and availability of many kinds of produce in east coast supermarkets is much worse than in the west coast supermarkets. Various steps are taken to attempt to improve the appearance and quality of produce subjected to extensive transportation. During the packing process, the produce is washed and often sprayed with cool water. A minimal amount of this water remains in the storage carton and is absorbed by the produce. Some packets place an absorbent pad soaked with cool water in the shipping carton to increase the amount of moisture available to the produce. While this small amount of liquid improves the quality of the shipped produce to nearby destinations, the liquid only lasts for a short period of time and has little effect in cross-country shipment. Produce is often shipped in refrigerated trucks and railcars, but refrigeration is expensive and is not entirely effective in preventing degradation of quality.

Since in many instances the produce may be stored in the shipping container for several days because of shipping delays, extended transportation time, and crowded produce bins, a shipping or produce packing assembly which is capable of extending the useful life and enhancing produce quality is highly desirable. Similarly, a method which efficiently increases the appearance and quality of the produce in remote markets has widespread usefulness.

Accordingly, a primary object of the present invention is to provide a packing system for fresh produce which enables the produce to be shipped, stored and arrive at remote marketplaces in better condition or the consumer.

Another object of the present invention is to provide a packing system which will lengthen the shelf life of fresh produce.

A further object of the present invention is to provide packaging for the transportation, storage, and marketing of fresh produce which enhances the freshness and appearance of the product to the consumer.

A more general object of the present invention is to provide a packing apparatus and method for fresh produce which enhances the quality of produce after a period of several days.

The assembly and method of the present invention has other objects and features of advantage which will become apparent from and are set forth in more detail in the description of the Best Mode Of Carrying Out The Invention and the accompanying drawing.

DISCLOSURE OF THE INVENTION

The produce packing assembly of the present invention includes a hollow container having a wall for holding fresh produce. The improvement in the packing assembly comprises, briefly, the container having a liquid collection volume for retaining a significant volume of a liquid and a passageway allowing excess liquid to flow from the interior of the container to the exterior. A plurality of pieces of produce are placed in the interior of the container with a portion of the produce pieces positioned within the collection volume. A significant quantity of liquid, such as water, is retained within the collection volume and in contact with the portions of the produce to thereby maintain the freshness of the produce over an extended period of time during transport or storage.

In another aspect of the present invention, a produce packing method is provided having the steps of depositing the produce in a storage container, and closing the storage container for transportation. The improvement in the method includes, briefly, the steps of providing a liquid impervious portion of the storage container which forms a liquid collection volume at the bottom of the container, introducing a liquid into the storage container to fill the liquid collection volume, and draining any excess liquid above the collection volume from the interior of the storage container.

BRIEF DESCRIPTION OF THE DRAWINGS

Additional objects and features of the present invention will be more apparent from the following detailed description and the appended claims, when taken in conjunction with the drawing, in which:

FIG. 1 is a front elevation view, in cross section, of a fresh produce containment assembly constructed in accordance with the present invention.

FIG. 2 is a top plan view of the container of FIG. 1 prior to folding the container to the shape as shown in FIG. 1.

FIG. 3 is an alternative embodiment of a fresh produce containment assembly constructed in accordance with the present invention.

FIG. 4 is a top plan schematic diagram showing a fresh produce packing line incorporating the method of the present invention.

FIG. 5 is a front elevation view, taken in cross section substantially along the plane of line 5—5 in FIG. 4, depicting a fresh produce containment assembly in accordance with FIG. 3 and illustrating the method of the present invention.

BEST MODE OF CARRYING OUT THE INVENTION

Reference now will be made in detail to the preferred embodiments of the invention, which are illustrated in the accompanying FIGURES. Turning now to the drawings, wherein like components are designated by like reference numerals throughout the various figures, attention is directed to FIGS. 1 and 3.

Fresh produce packing or containment assemblies, generally designated 10, which are constructed in accordance with the present invention, are shown in

FIGS. 1 and 3. Packing assembly 10 includes a hollow container 12 with walls formed to contain a plurality of pieces of fresh produce 16 for transport and/or storage. In the form of the invention in FIG. 1, container 12 is a composite carton or box-like container including relatively rigid, self-supporting walls which will support, as well as contain, produce. In the form of the invention shown in FIG. 3 container 12 of packing assembly 10 is a flexible plastic bag which contains the produce when upper end 15 is secured by an end-closure 18. In either case container 12 can be used to handle, transport and/or store produce pieces 16.

In order to greatly enhance the freshness of produce stored and transported by packing assembly 10, container 12 includes liquid impervious means, such as liner 8 in the box of FIG. 1, or an integrally formed imperforate portion 8*a* in the bag of FIG. 3, which defines therein a liquid collection volume 22 at bottom 4 of the container. Since it is not desirable to transport an unnecessary amount of liquid, and since some produce can be adversely affected by prolonged storage while totally immersed in a liquid such as water, packing assembly 10 further preferably includes passageway means, such as apertures 14 in the bag of FIG. 3 and upper edge 7 of liner 8 and pores (not shown) in the carton walls of the box of FIG. 1. Such passageway means permits communication of liquid above volume 22 from the interior of container 12 to the exterior of the container.

As will be described in detail below, therefore, container 12 can be filled with a liquid, such as water, and the excess, that is, the volume above volume 22 will drain out of the container. Liner 8, or imperforate wall 8*a*, in the bottom of the container will trap or retain a substantial volume of water which then can be used to maintain the freshness of produce packaged by the packing assembly and in contact with the retained water.

Packing assembly 10 preferably is employed to ship and store relatively fragile and yet compact produce which will benefit from continuing liquid immersion. Asparagus is particularly well suited for transport and storing using the packing assembly of the present invention. Asparagus has a relatively uniform diameter over its length. It has a short shelf life, sells for a premium price, and will significantly benefit from immersion of its butt ends in water during storage. Under some conditions, asparagus actually will continue to grow after cutting if stored in the packing assembly of the present invention. It will be understood, however, that other kinds of produce also are candidates for the present packing assembly. Thus, celery, carrots, rhubarb, among others, may benefit to varying degrees from the present apparatus and method.

In the preferred application asparagus spears 16 are positioned or held within container 12, with their butt ends resting in liquid collection volume 22. A quantity of liquid, preferably water or water with a nutrient and/or preservative, is retained within liner 8 or imperforate bag bottom 8*a*, and the water is available for absorption by the asparagus spears positioned in collection volume 22. While in contact with the water, the asparagus spears will absorb the liquid through capillary action and in some cases, even continue to grow.

The collection volume, which is defined by liner 8 and bag portion 8*a*, may contain an amount of liquid selected to correspond to the transportation or storage time period which the produce must undergo. Volume 22 could be larger for asparagus destined for New York than for those destined for Texas. Thus, asparagus spears shipped completely, or only partially, across the United States in containment assembly 10 with water in volume 22 will arrive in good condition and will have a significantly extended shelf life.

The composite box or carton-like container of FIG. 1 preferably is formed of a corrugated cardboard which is impregnated with a resin, plastic or other material to prevent its breakdown when contacted with water. Such cartons are well known in the produce packing industry and have been employed for years in the shipping of asparagus. Such conventional asparagus shipping cartons, however, do not contain a liner 8 defining a water retention volume 22. Instead, conventional asparagus shipping cartons are not capable of retaining significant volumes of water since seams, openings in the carton walls and cardboard inherent porosity causes the cartons to drain water from their interior.

When a water impervious liner 8 is placed in a conventional asparagus shipping box, however, the drainage inherent in the box structure functions to provide passageway means for drainage of water above edge 7 of the liner from the packing assembly. Thus, the height of the liner side walls and of edge 7 is used to control liquid retention or collection volume 22, with the excess volume draining from the carton without causing breakdown of the mechanical integrity of the carton.

FIG. 2 illustrates container 12 and water impervious liner 8 prior to folding into the self-supporting carton of FIG. 1. Liner 8, which is larger than bottom panel 4 of the container, is placed substantially over the bottom panel. Dotted lines 11 denote the fold lines between side walls 5 and bottom wall or panel 4. In the present embodiment, one or more edges 7 of liner 8 are secured to one or both of side walls 5 by gluing at 13 prior to folding of the carton. Liner 8 conforms with side walls 5 and bottom wall 4 during folding to form collection volume 22 (FIG. 1) within container 12, as shown in FIG. 1. Hand holes 9 and hydro-cooler water inlet holes 13 are provided in top panel 6 and various side panels. The result is an open-topped liquid collection volume 22 in bottom of the shipping box 12 which can be easily packed with asparagus and will readily collect and retain water introduced into the interior of the box.

In the embodiment of packing assembly 10 of FIG. 3, container 12 has a flexible wall or membrane which is formed from a polymeric, or another suitable liquid impervious material, and has a plurality of apertures 14 and a liquid collection volume 22 at the bottom of the container. The size and frequency of spacing of apertures 14 can be varied to allow for the passage of a large amount of water into or out of the container within a short amount of time. Collection volume 22, defined by an area 8*a* of the flexible container wall at the bottom of the bag having no apertures 14, retains a significant quantity of water within the container. The size of collection volume 22 may be varied by shifting the location, and particularly the height, of apertures 14 which determine the location of water line 20. Thus, by a slight and inexpensive modification in the manufacture of the bag containers, packing assembly 10 may retain varying amounts of water.

A pre-selected number or weight of asparagus spears 16 are contained within bag container 12, which has its upper end 15 securely closed by closure tab 18. A butt portion of each of asparagus spears 16 rests in collection volume 22, which preferably is initially filled with water. In this embodiment, bag container 12 typically

holds approximately one pound of the asparagus spears, which allows the container of the present invention to act as a convenient marketing or consumer handling device. Thus, bags 12 of asparagus spears 16 with water in them can be placed directly in the grocery store or supermarket display bins, and the consumer can use the bags to carry the bunches of asparagus home. The packaging, as well as the improved quality of produce, enhances the attractiveness and consumer handling of the produce.

An advantage of bag containers 12 is that water may be added to collection volume 22 by the grocer at a later time without disturbing the packaging of asparagus spears 16. The bags, for example, may be dipped into a trough or pool of water to replenish the water. The water will flow through apertures 14 and into bag container 12, and any excess water will drain from container 12 through apertures 14. Thus, the shelf life of the asparagus may be maintained or extended easily by the grocer by periodically adding water to the containers at the supermarket.

Turning now to FIG. 4, a schematic diagram showing a method for packing fresh produce designed according to the present invention is schematically depicted. For convenience, the method of the present invention will be described in conjunction with the embodiment of containment assembly 10 as illustrated in FIG. 3. The composite carton shown in FIG. 1, however, or additional embodiments of the containment assembly of the present invention, may be substituted for the assembly of FIG. 3 in teh present method.

After being picked in the field, the asparagus spears qre brought into the packing area on a field sled 23. Asparagus spears 16 are placed on conveyor belt 26 with the top or flower portion against guide bar 28 by an unloader 24. The asparagus are straightened and culled by workers 24*a*. After a cutting mechanism 30 ensures that the asparagus spears fall within a defined maximum length, asparagus spears 16 pass through washer 32.

Once they have been washed, asparagus spears 16 are sorted by sorters 24*b* according to their diameter. At the left end of conveyor 26 sorters 24*b* merely place sorted asparagus in a sort rack 34. Boxers 24*c* remove the asparagus and place the same in boxes or cartons 36 on box bench 37. Personnel 24*c* boxing the asparagus may place the asparagus in a bag or add a rubber band to band the asparagus in bunches before placing the bags or bunches in boxes, or they may simply pack the asparagus loosely in the boxes. When box 36 is filled, the boxer closes the box lid 36*a* and places the filled box on conveyor 38.

As thus far described the asparagus packing line of FIG. 4 is identical to lines used with convention asparagus shipping boxes or cartons.

At the right end of conveyor 26 an alternative semi-automated packing sequence is illustrated. Sorter 24*b* places sorted asparagus into a tilting scale 35. When a predetermined weight is reached, for example, one pound, the scale tilts and slides the weighed asparagus bunch into an automatic bagging machine 39. Bagging machine 39 holds the bag in a distended position to receive the asparagus and then closes the bag with a band or closure tab 18. The closed bag is then placed automatically, or by a worker 24*c*, into box 36. Again, this bagging alternative is known in the produce industry and does not form a novel portion of the present invention.

In the improved method of the present invention the bags used to bag asparagus, either manually or by machine, are formed with a plurality of openings 14, as shown in FIG. 3, or the boxes or cartons 36 are provided with liners 8, as shown in FIG. 1. Moreover, in the improved method a liquid, usually water, is added to the composite cartons or perforated bags 12, for example, by immersing the same in water. The water passes into the interior of the improved containers through passageway means, such as apertures 14, or openings 50 in the boxes and substantially fills liquid collection volume 22.

As shown in FIGS. 4 and 5, immersion of the liquid retaining shipping containers of the present invention can be accomplished by transporting boxes 36 by conveyor 38 through a water pool or trough 40. At this time, water fills the shipping box through openings 50 and passes through apertures 14 of bags 12 or down through the open top of box liner 8. At drain area 42 a substantial amount of the excess water, not retained within collection volumes 22 of bags 10, or liner 8, drains from the bags and shipping box 36. At a sealing conveyor 43 boxes 36 are stapled closed by workers 24*d* and then conveyed by conveyor 47 to a hydro-cooler 46.

Asparagus spears 16 are cooled, as in standard packaging procedures, by moving shipping box 36 onto a wide, slowmoving conveyor belt 44 by worker 24*e*, and the boxes slowly pass through hydro-cooler 46. While in the hydrocooler, shipping box 36 is sprayed with cool water, some of which will be retained within volumes 22 of any unfilled bags or in liner 8. After shipping boxes 36 leave hydro-cooler 46, a final conveyor belt 48 moves the shipping boxes to either a storage area or a loading dock.

In the present embodiment, collection volume 22 preferably is filled with water by dipping the lined box or the box of bags into a pool of water. Thus, a significant quantity of water is efficiently introduced into the containment volume during the packing process. Alternatively, however, bags 12 or composite carton 12 may be filled by adapting hydro-cooler 42 to apply a sufficient amount of water to shipping box 36 during the cooling process to fill volumes 22. In a further alternative the water may be added to the containers by opening the tops of the bags prior to boxing the bags, or opening the tops of composite cartons 12 prior to sealing the cartons, and filling the containers, preferably to a level above volume 22, with water.

A cross sectional view of a containment assembly 10 passing through water pool 40 of FIG. 4 is schematically shown in FIG. 5. Shipping box 36 passes through water pool 40 on conveyor belt 38. Water 52 passes into shipping box 36, as shown by arrows 53, by means of several holes 50 located on the six sides of the shipping box. As the water fills shipping box 36 it in turn passes through apertures 14 into containers 12, which is also indicated by arrows 55.

As indicated by water lines 20, not all containers 12 are completely filled while shipping box 36 is submersed in water pool 40. However, enough water 52 preferably enters each of containers 12 to fill at least collection volume 22, with the excess water 52 above the lowermost apertures 14 draining out of the bags through the apertures and out of the cartons 36 through holes 50, seams and carton pores. Thus, the fresh produce containment assembly and method of the present invention efficiently provide and retain a significant quantity of

water in contact with the produce to sustain the produce during transportation and storage, without adding unnecessarily to the shipping weight or undesirably soaking the entire produce piece during transport. While the preferred embodiment has been discussed in relation to asparagus, other types of produce may be packaged using the present invention. Additionally, a nutrient-enriched liquid may be substituted for or added to the water.

What is claimed is:

1. A produce packing assembly suitable for storing and transporting fresh produce comprising:

(a) a hollow container having a wall formed to completely surround and contain a plurality of pieces of produce for transport and storage, said wall defining a closeable open upper end for receipt of produce therethrough, said container including liquid impervious means provided at a bottom end thereof, said liquid impervious means defining a liquid collection volume at said bottom end of said container having a size sufficient to retain enough liquid therein for extended transport of produce, and passageway means positioned below said open upper end and above said bottom end, said passageway means having a size for introducing a large amount of liquid into the interior of said container from the exterior of said container in a relatively short period of time and communicating any excess liquid from the interior of said container above said collection volume to the exterior of said container;

(b) a plurality of produce pieces positioned in and surrounded by said container with a lower portion thereof positioned in said liquid collection volume; and

(c) a quantity of said liquid contained in said liquid collection volume and contacting said produce pieces for absorption of said liquid by said produce pieces during transport and storage.

2. The produce packing assembly of claim 1 wherein,

said liquid impervious means is provided by an open topped liquid impervious liner mounted adjacent to said wall at said bottom of said container, and

said passageway means is provided by an upper edge of said open topped liquid impervious liner.

3. The produce packing assembly of claim 1 wherein,

said liquid impervious means and said wall are integrally formed at said bottom of said container.

4. The produce packing assembly of claim 1 wherein,

said passageway means includes a plurality of apertures within said wall, said passageway means opening into the interior of said container, said apertures being sufficiently large in size to provide for the passage of a substantial amount of liquid through said apertures into the interior of said container in the short period of time during which said container is traveling on a conveyor belt passing through a trough of water.

5. The produce packing assembly of claim 1 wherein,

said passageway means includes a plurality of apertures within said wall, said apertures being configured and positioned to allow for the movement of a volume of said liquid larger than said liquid collection volume into the interior of said container above said collection volume in a relatively short period of time.

6. The produce packing assembly of claim 1 wherein,

said liquid impervious means is provided by a plurality of polymeric container each having a liquid impervious wall with a plurality of apertures in said wall above a bottom portion of said polymeric containers, said apertures being of a size sufficient to permit the movement of a substantial amount of liquid between the interior and exterior of said polymeric containers during a brief period of time.

7. The produce packing assembly of claim 6 wherein,

a plurality of said pieces of produce are mounted within each of said polymeric container.

8. In a method for packing fresh produce including the steps of assembling a storage container having a wall for containing and supporting said produce pieces, depositing a plurality of produce pieces into said storage container, and closing said storage container to secure and completely contain said produce pieces therein for transport and storage, the improvement in said method for packing comprising the steps of:

providing a liquid imperious material in said storage container to thereby form a liquid collection volume having a size sufficient to retain enough liquid therein for extended transport of produce defined by said liquid impervious material at the bottom of said assembled storage container;

introducing a significant amount of liquid into said storage container during a brief period of time for accumulation within said collection volume through a plurality of apertures formed in said storage container; and

draining any liquid exceeding the amount accumulating within said collection volume from said storage container through said plurality of apertures.

9. The improvement in the method for packing fresh produce of claim 8 wherein,

said providing step is accomplished by placing said liquid impervious material adjacent to said storage container prior to said assembling step, affixing a portion of said liquid impervious material to said storage container prior to said assembling step and assembling said storage container with said liquid impervious material to form said liquid collection volume at the bottom of said container.

10. The improvement in the method for packing fresh produce of claim 8 wherein,

said introducing step is accomplished by placing said container on a conveyor belt traveling through a trough of water such that, while said container travels through said trough of water, a significant amount of liquid flows through said apertures and accumulates in said collection volume.

11. The improvement in the method for packing fresh produce of claim 8 wherein,

said draining step includes allowing said excess liquid to pass through passageway means in said wall of said storage container.

12. The improvement in the method for packing fresh produce of claim 8 wherein,

said draining step includes allowing said excess liquid to exit from said storage container through a plurality of apertures formed within said wall.

13. In a method for packing fresh produce including the steps of sorting a plurality of produce pieces by size, depositing said produce pieces into a storage container, and closing said storage package thereby securing and completely containing said produce pieces within said storage package, the improvement in said method for packing comprising the steps of:

(a) selecting a hollow storage container with a wall having a plurality of apertures opening into the

interior of said container for quickly passing a large amount of liquid therethrough and having a liquid collection volume of significant size defined by a liquid impervious material at a bottom of said container for retaining said liquid therein;

(b) immersing said container in a liquid and allowing a large quantity thereof to pass through said apertures and into said container in a relatively short period of time; and

(c) removing said container from said liquid and allowing any liquid exceeding the amount retained within said collection volume to drain from said container through said apertures.

14. A produce packing assembly suitable for transporting, storing, and marketing fresh produce comprising:

(a) a storage container having a wall with a plurality of apertures extending therethrough;

(b) a plurality of package containers mounted within said storage container, said package containers having a liquid impervious wall formed as a flexible polymeric material and a liquid collection volume partially defined by said wall for retaining liquid therein, said wall having a plurality of apertures configured and positioned for the passage of a significant amount of liquid between the interior of said storage container and the interior of said package containers over a brief period of time;

(c) a plurality of pieces of produce mounted within said package container with a portion thereof positioned within said liquid collection volume, said package container surrounding and completely containing; and

(d) a quantity of liquid retained within said liquid collection volume for absorption by said pieces of produce during transport and storage.

* * * * *

United States Patent Office 3,814,820 Patented June 4, 1974

3,814,820

FRUIT AND VEGETABLE CONTACT WITH CHLORINE CONTAINING BIOCIDES AND DISCOLORATION INHIBITORS

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Int. Cl. A23l 3/00
U.S. Cl. 426—262 12 Claims

ABSTRACT OF THE DISCLOSURE

The process of treating lettuce and other salad ingredients to extend or prolong their quality and reduce microbiological contamination. Dismembered lettuce (i.e. sliced, chopped or otherwise fractured) is treated under controlled conditions as follows:

(1) Washed in a cleansing solution;
(2) Rinsed in potable water;
(3) Contacted with an aqueous sanitizing agent (e.g. sodium hypochlorite);
(4) Optionally rinsed again in potable water;
(5) Contacted with a discoloration inhibitor in the optional presence of a chelating agent; and
(6) Extracted of excess discoloration inhibitor.

BACKGROUND OF THE INVENTION

In the past, various methods have been proposed for the treatment of certain fruits and vegetables (e.g. potatoes) to prevent discoloration. In this respect, see U.S. 2,506,793 which issued on May 9, 1950 to Arthur F. Kalmar et al. and U.S. 2,628,905 which issued on Feb. 17, 1953 to Lloyd L. Antle et al. Similarly, various techniques are known in the art for reducing fungicidal activity on certain vegetables (e.g. see again U.S. 2,506,93).

However, lettuce, whether processed alone or in admixture with other salad ingredients (i.e. vegetables and fruits) poses special problems to food processors. After lettuce has been sliced, chopped, fractured or otherwise dismembered it is or becomes quite sensitive to treatment and it is difficult to process such dismembered lettuce without undesirably modifying the natural or fresh appearance, flavor, texture or cell structure of the lettuce.

Although various methods have been suggested for use in the processing or treatment of fruits and vegetables including lettuce, no single process of which we are aware can be successfully applied on a commercial scale to dismembered lettuce to inactivate or inhibit pathogenic microorganisms (e.g. salmonellae staphylococci, and *Escherichia coli*), to inactivate or inhibit microorganisms that contribute to the spoilage of the lettuce, and also retard discoloration and slime formation.

The lack of an effective treating process is a serious disadvantage to those engaged in the preparation of prepared salads or salad-forming ingredients for subsequent sale and use by industrial and institutional food service operations (e.g. hospitals, restaurants and schools), and for resale by retail food outlets (e.g. supermarkets).

SUMMARY OF THE INVENTION

The present invention is a process which is effective in the treatment of dismembered lettuce. The process will reduce microbial populations, retard discoloration and slime formation, and otherwise extend the quality of dismembered lettuce. Although this process is distinctively different from prior art processes in that it is effective with dismembered lettuce, it can be used in the treatment of other salad ingredients (i.e. fruits and vegetables).

Briefly described, the process of this invention as applied to lettuce is as follows:

(1) Lettuce is washed in a cleansing solution;
(2) Rinsed in potable water;
(3) Contacted with an aqueous sanitizing agent (e.g. sodium hypochlorite);
(4) Optionally rinsed again in potable water;
(5) Contacted with a discoloration inhibitor in the optional presence of a chelating agent;
(6) Extracted of excess discoloration inhibitor.

DETAILED DESCRIPTION

The process of the present invention is a combination process which permits one to treat lettuce and other salad-forming ingredients (separately or in admixture with each other) to thereby produce edible products which maintain their high quality and which meet the increasingly rigid health standards of various institutional food service buyers (e.g. hospitals, restaurants, schools and retail outlets).

In treating fruits and vegetables, particularly, lettuce, it is important for the temperature of the product being treated to be lowered and maintained at a low temperature to achieve optimum quality and maximal shelf life. Accordingly, it is desirable for the various processing steps set forth herein to operate at temperatures whereby the cumulative effect is to lower the temperature of the product being treated. For lettuce, a particularly desirable final temperature is as close to 32° F. as possible without freezing.

Producs to be treated

Lettuce is the primary product to be treated in the process of this invention. The lettuce can be treated alone, or in admixture with other vegetables. However, the process of this invention can be applied to other vegetables and to fruits. Typical products which can be treated (other than lettuce) include radishes, celery, celery or chinese cabbage, carrots, endive or chicory, romaine, escarole, red cabbage, parsely, cherry tomatoes, cauliflower, green peppers, and the like. The various products can be treated whole, sliced, chopped, fractured or otherwise dismembered with the choice of form (e.g. sliced or whole) depending in a large measure upon the type of product and the desired end use. For example, lettuce is preferably treated in a dismembered state while cherry tomatoes are preferably treated whole.

Step 1 (cleaning)

In the first step of this process, the product is washed in a cleansing solution, usually an aqueous solution or in dispersion of a suitable detergent or other surface active agent. Phosphate (sodium tripolyphosphate) and sulphate (sodium lauryl sulphate) detergents are well suited for this purpose. Suitable detergents and other cleansing aids are commercially available. The temperature of the washing or cleansing solution should be between 32° F. and 70° F. preferably from 40° F. to 60° F. The time of treatment with the cleansing solution can vary, although times of from 15 seconds to 1 minute, especially 20–40 seconds, being preferred. The pH of the washing solution should be within the range of 5.5 to 9.5 with pH's from 7 to 9.5 being preferred. A particularly preferred level of pH is from 8–9.

Although the amount of detergent or other cleaning agent used to form this solution may vary widely depending upon the type of detergent or cleansing agent, levels of from 0.005 to 0.40 grams per 100 ml. of water are often adequate. Suitable pH levels can be obtained or maintained by the use of suitable buffering agents as known in the art.

Step 2 (rinsing)

This step is essential to the practice of this invention. We have found that prompt rinsing of the products being processed to remove the cleansing solution of Step 1 must be done if one wishes to retain the quality of the lettuce or other product being treated. The rinsing solution is any potable water. The temperature of the rinse water can range from 32° F. up to 45° F., with the lower temperatures being preferred. It is useful if the rinse water is cold (e.g. 32° F.–37° F.) so that cooling and rinsing are affected at the same time.

Step 3 (sanitizing)

In the third step, the products being treated are contacted with an aqueous solution of a suitable sanitizing agent to thereby reduce the microbial population of the product to a desired level. Sanitizing agents of the chlorine species are preferred (e.g. hypochlorites and chlorine dioxide). Hydrogen peroxide is effective, but requires the use of a secondary treatment.

The temperature of the sanitizing solution should be within the range of 32° F. to 45° F., with the preferred temperature being within the range of 32° F. to 37° F.

Step 4 (optional rinsing)

In this step, which is optional but preferred, the product is again rinsed with a potable water. This rinsing can serve to further cool the product and removes residual sanitizing agents. Rinsing is desirable if high levels of chlorine-releasing sanitizing agents have been used in Step 3 since high chlorine levels sometimes cause cell damage of lettuce and other products. Temperatures within the range of 32° to 45° F., preferably 32° to 37° F. are useful during this step.

Step 5 (inhibiting discoloration)

In this step, the products being treated are contacted with a solution of a suitable discoloration inhibitor. Suitable inhibitors and techniques for their application are known to those skilled in the art and include materials which are effective in reducing enzymatic browning and other color producing actions. See, for example, U.S. 2,628,905.

The pH during this step should be within the range of 3.5–9.5, preferably from 5.8 to 6.5. A particularly useful group of discoloration inhibitors are ascorbic acid and those producing sulphur dioxide (e.g. sodium bisulfite). The temperature of treatment to inhibit discoloration should again be within the range of 32°–45° F., with temperatures in the range of 32° to 37° F. being particularly preferred.

The effectiveness of this step of the process can be enhanced by the additional use of chelating agents. Suitable chelating agents include those which effectively remove divalent cations such as copper from solution. Such divalent cations catalyze color-producing reactions if they are not removed. Suitable chelating agents include calcium disodium ethylene diaminetetraacetic acid, citric acid and certain pyrophosphates.

Step 6 (extraction)

In this step, the products from Step 5 are processed to extract or otherwise remove excess solution of the discoloration inhibitor. Various methods of extraction can be used. One useful technique is to place the product being processed (e.g. lettuce) in a supported position (e.g. on a grill, mesh or other support) to permit draining and thereafter basket centrifuging the product to remove additional inhibitor solution.

After the processing has been completed, the lettuce, alone or in admixture with other salad forming ingredients, should be stored at or near its optimum storage temperature. For lettuce, the optimum storage temperature is as close to 32° F. as is possible without freezing the lettuce.

The present invention will be further understood by reference to the following specific examples. Unless otherwise indicated, all parts and percentages are by weight.

EXAMPLE I

Head lettuce at about 60° F. was uncrated, a few of the outer leaves on each head were removed and discarded, the heads then cored, and finally chopped to salad size pieces. The dismembered lettuce was then placed in a mesh container which was processed according to the following sequence:

(1) Dipped into an aqueous solution of a mixed condensed phosphate/sulphate detergent (a product of SEPKO Chemicals, Inc. of Minneapolis, Minnesota) for 30 seconds. The wash solution contained 0.2 grams of powdered detergent per 100 ml. of water. The water temperature was 60° F. and the pH of the wash solution was 8.5.

(2) After 30 seconds of washing, the container filled with dismembered lettuce was removed from the cleansing solution and immediately rinsed in tap water at 35° F.

(3) The container of dismembered lettuce was then dipped for 30 seconds into an aqueous solution of sodium hypochlorite at 35° F. The concentration of sodium hypochlorite was sufficient to provide 25 p.p.m. chlorine.

(4) Next, the dismembered lettuce was immediately rinsed with tap water at 35° F.

(5) The lettuce was then dipped into an aqueous solution of sodium bisulfite at 35° F. for 30 seconds. The solution was prepared from a commercially available vegetable treating product (Vege-Fresh, a product of Universal Foods of Milwaukee, Wis.) which contained appropriate buffers to give a pH of 5.8 when used at a level of 0.5 grams of product per 100 ml. of water. In addition to the sodium bisulfite, the solution contained tetrasodium pyrophosphate and sodium acid pyrophosphate.

(6) After 30 seconds exposure to the solution of Step 5, the container of dismembered lettuce was removed and suspended to permit draining for approximately 2–3 minutes. Thereafter, the lettuce was centrifuged in a basket centrifuge to further remove solution from Step 5.

(7) The product of Step 6 was then stored just above 32° F. prior to being mixed with other salad-forming ingredients and packaged as a prepared salad.

The resulting product (i.e. treated lettuce) was found to be of improved quality when compared to other lettuce prepared by conventional processes. Discoloration and slime formation were reduced and the fresh appearance, flavor, texture, and cell structure of the lettuce were retained at a high level for a longer period of time as contrasted to lettuce treated according to conventional processes. Laboratory analysis for pathogenic organisms (e.g. salmonellae and staphylococci) were negative and the products met current health standards of some institutional users of such products (e.g. hospitals and schools), and the standards of public health agencies monitoring retail products.

What is claimed is:

1. A process of treating a product selected from the group consisting of vegetables and fruits, which comprises the steps of:

(a) washing a product to be treated in an aqueous cleaning solution at a temperature of from 32°–70° F.;

(b) promptly rinsing washed product of step (a) with potable water;

(c) contacting the rinsed product of step (b) with an aqueous sanitizing solution to thereby inactivate unwanted micro-organisms, said sanitizing solution comprising a chlorine-containing sanitizer selected from the group consisting of hypochlorites and chlorine dioxide;

(d) contacting sanitized product of step (c) with a solution of a discoloration inhibitor selected from the group consisting of ascorbic acid and sulfur dioxide-producing discoloration inhibitors; and

(e) removing excess solution of step (d) from said product.

2. Processes of claim 1 wherein the aqueous cleaning solution of step (a) has a pH of 5.5–9.5.

3. Processes of claim 2 wherein the water of step (b) has a temperature of 32°–45° F.

4. Processes of claim 3 wherein sanitized product from step (c) is rinsed with potable water prior to step (d).

5. Processes of claim 4 wherein the solution of the discoloration inhibitor has a pH of at least 5.8 and contains sodium bisulfite.

6. Processes of claim 5 wherein said product is dismembered lettuce.

7. A process of treating lettuce which comprises the steps of:

(a) washing dismembered lettuce in an aqueous cleansing solution at a pH of 8–9 and a temperature of from 32°–70° F. for from 15 seconds to one minute;

(b) promptly rinsing washed lettuce of step (a) with potable water at a temperature of from 32°–45° F.;

(c) contacting rinsed lettuce of step (b) with a sanitizing solution at a temperature of from 32°–45° F., said solution comprising a sanitizer selected from the group consisting of hypochlorites and chlorine dioxide;

(d) rinsing sanitized lettuce from step (c) with potable water at a temperature of from 32°–45° F.;

(e) contacting rinsed lettuce from step (d) with a solution of a discoloration inhibitor at a pH of 5.8–6.5 and a temperature of from 32°–45° F., said discoloration inhibitor being selected from the group consisting of ascorbic acid and sulfur dioxide-producing discoloration inhibitors; and

(f) removing excess inhibitor solution from the lettuce of step (e).

8. Processes of claim 7 wherein the sanitizing solution of step (c) contains sodium hypochlorite.

9. Processes of claim 8 wherein the solution of the discoloration inhibitor contains sodium bisulfite.

10. Processes of claim 9 wherein said solution of the discoloration inhibitor also contains a chelating agent.

11. Processes of claim 10 wherein lettuce, only, is treated.

12. Processes of claim 10 wherein lettuce is treated in admixture with other salad forming ingredients.

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NORMAN YUDKOFF, Primary Examiner

H. H. BERNSTEIN, Assistant Examiner

U.S. Cl. X.R.

426—268, 270, 286, 335

US005711980A

United States Patent [19]

Terry

[11] Patent Number: 5,711,980

[45] Date of Patent: Jan. 27, 1998

[54] **PROCESSING AND PACKAGING METHOD FOR COMBINED PRODUCE TYPES**

[75] Inventor: **Mark Terry**, Fresno, Calif.

[73] Assignee: **Cal-State Material Handling Systems, Inc.**, Fresno, Calif.

[21] Appl. No.: **637,039**

[22] Filed: **Apr. 24, 1996**

[51] Int. Cl.[6] **B65B 55/00**; A23B 7/00

[52] U.S. Cl. **426/392**; 47/1.01; 62/78; 134/10; 210/805; 426/419

[58] Field of Search ..... 426/106, 321, 426/324, 326, 327, 335, 418, 419, 615; 210/167, 705, 805; 209/509, 606, 629, 659, 667, 673; 134/10, 111; 422/40, 41; 198/340, 398, 617; 47/1 R, 58 L, 58 EM, 58 EC, 58 T

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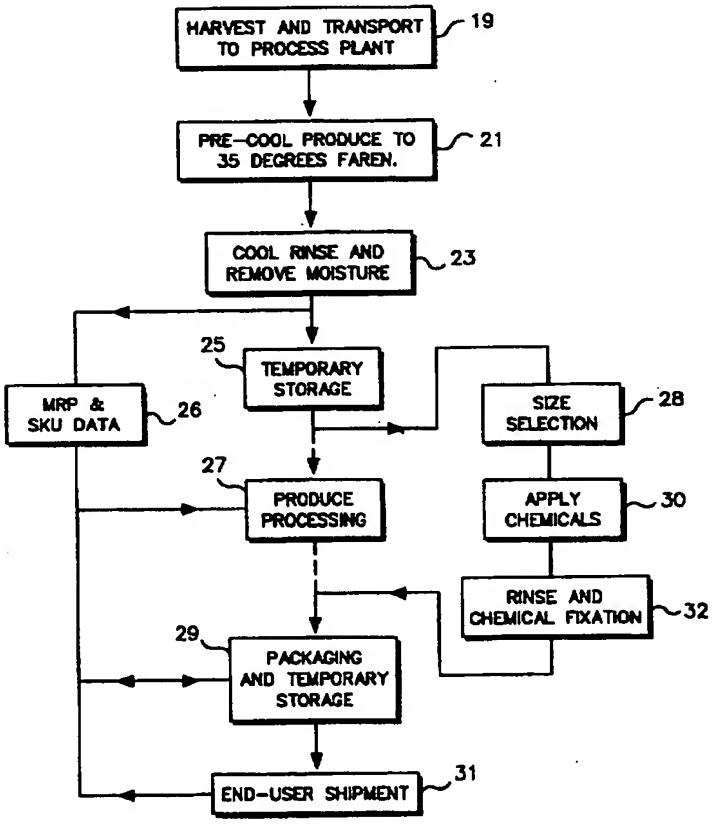
Primary Examiner—Joseph W. Drodge
Attorney, Agent, or Firm—Fenwick & West LLP

[57] **ABSTRACT**

A method for extending the shelf life of harvested produce against decay and premature ripening includes initial cooling of the produce, and thereafter maintaining the produce at the reduced temperature and at high humidity during processing and storage and packaging to final shipment for consumption. Cooled water with preservative chemicals rinse the produce at initial processing to suppress the ripening process significantly. Subsequent temporary storage between processes and processing steps occur substantially at the reduced temperature and high humidity to maintain the produce in a state of reduced ripening activity. The harvested produce is cut up and sized for volume collection and temporary storage as infeed to combining and packaging processes as required. Prescribed amounts of selected produce are individually packaged and crated for shipment in cooled and humid cargo carriers to remote locations where shelf life against decay and premature ripening is significantly extended.

7 Claims, 6 Drawing Sheets



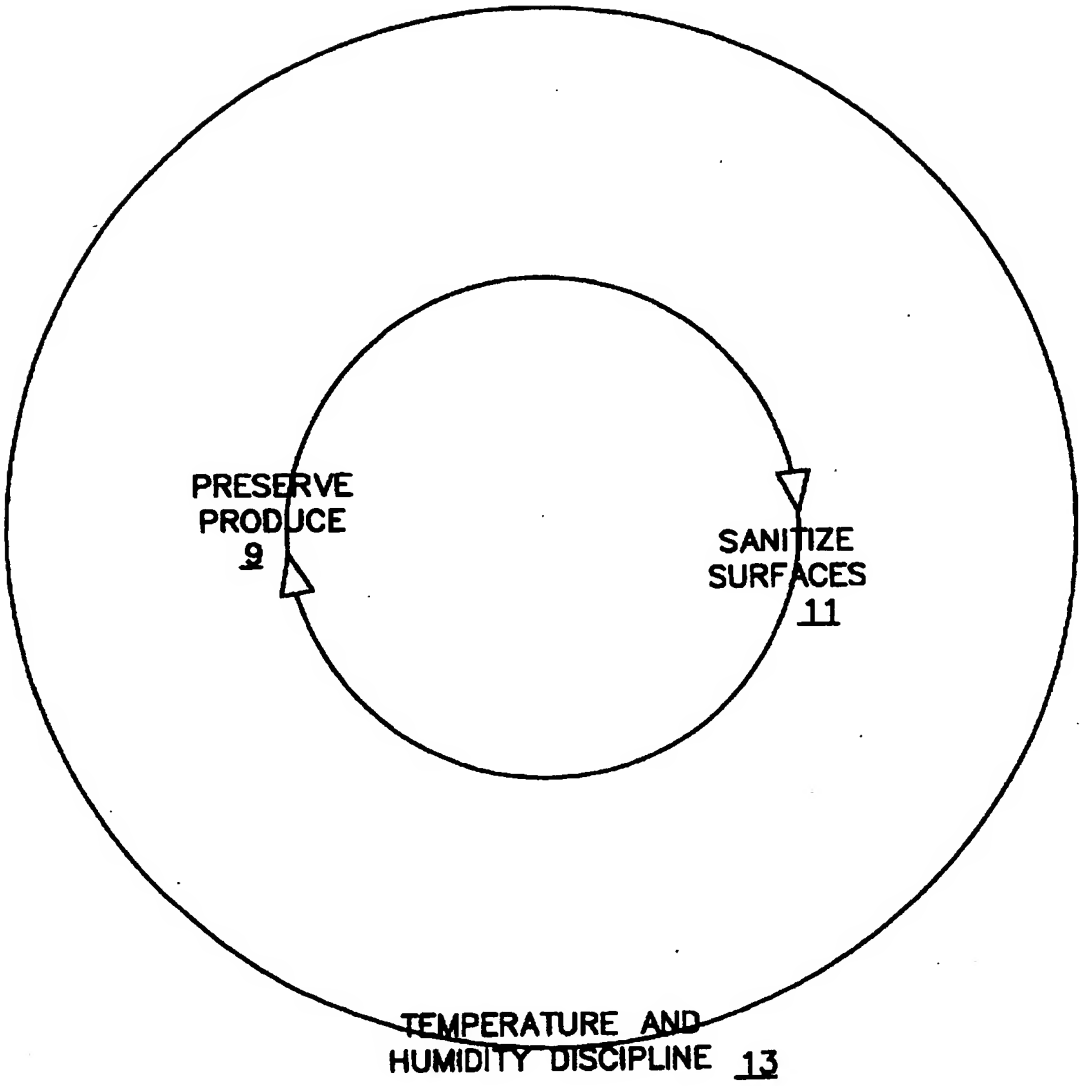

PRESERVE
PRODUCE
9
SANITIZE
SURFACES
11
TEMPERATURE AND
HUMIDITY DISCIPLINE 13

FIGURE 1

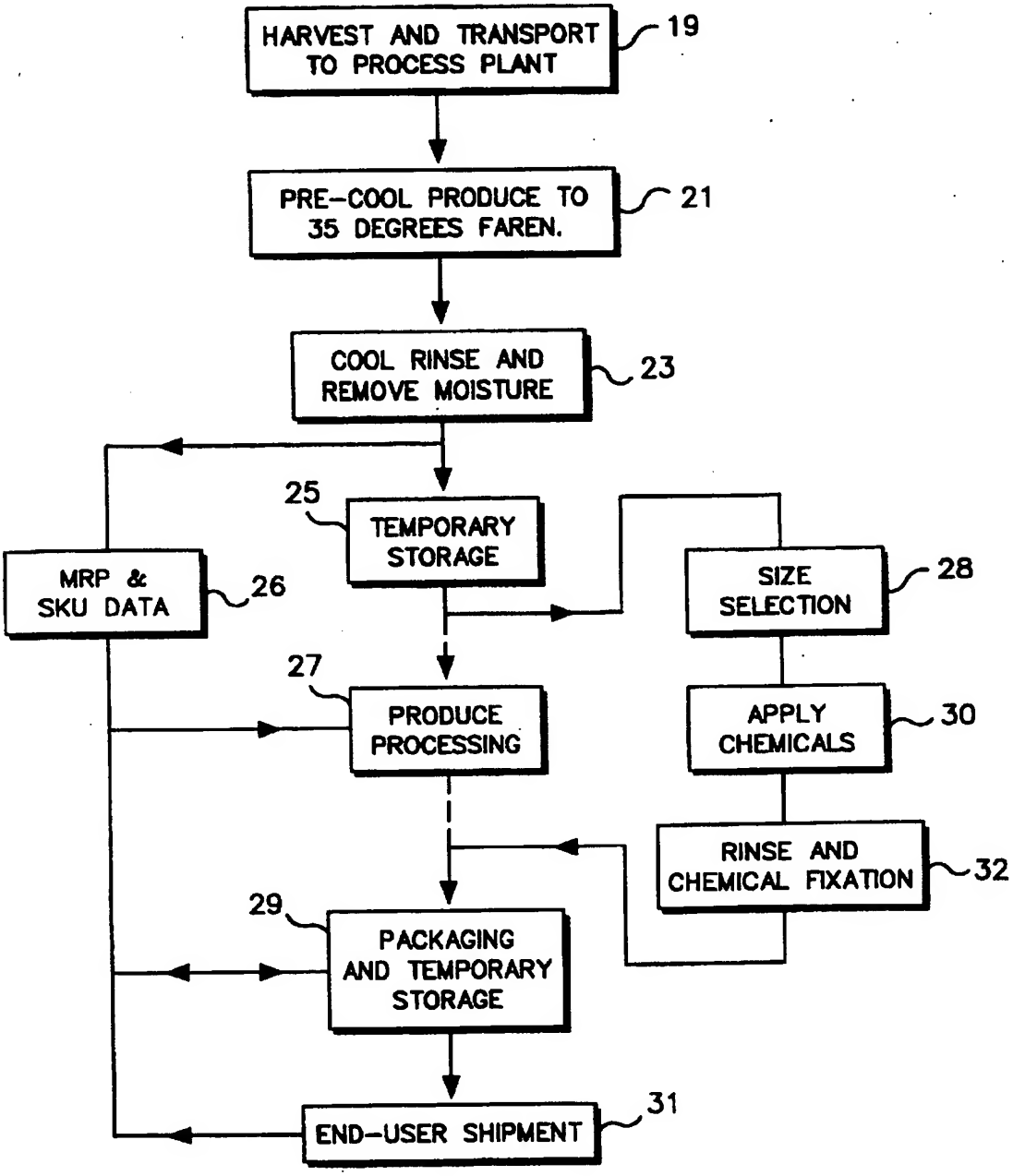

HARVEST AND TRANSPORT TO PROCESS PLANT
19
PRE-COOL PRODUCE TO 35 DEGREES FAREN.
21
COOL RINSE AND REMOVE MOISTURE
23
25
TEMPORARY STORAGE
MRP & SKU DATA
26
SIZE SELECTION
28
27
PRODUCE PROCESSING
APPLY CHEMICALS
30
RINSE AND CHEMICAL FIXATION
32
29
PACKAGING AND TEMPORARY STORAGE
END-USER SHIPMENT
31

FIGURE 2

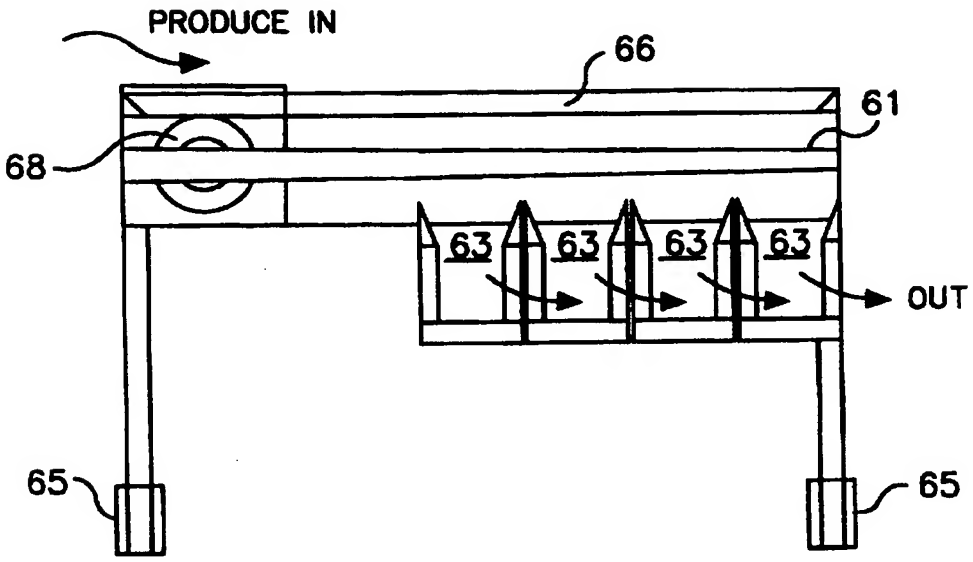


FIGURE 3A

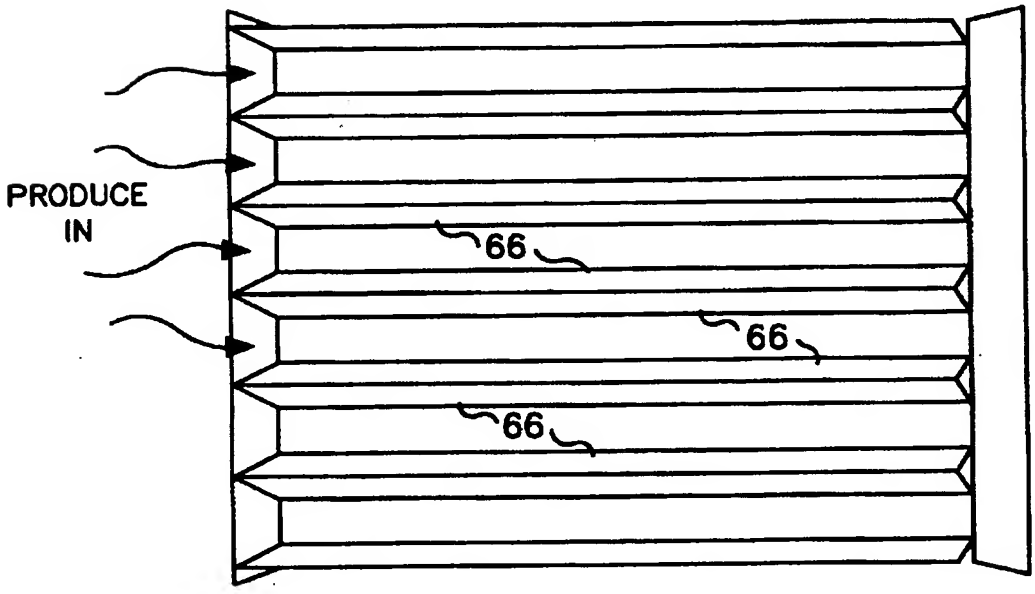


FIGURE 3B

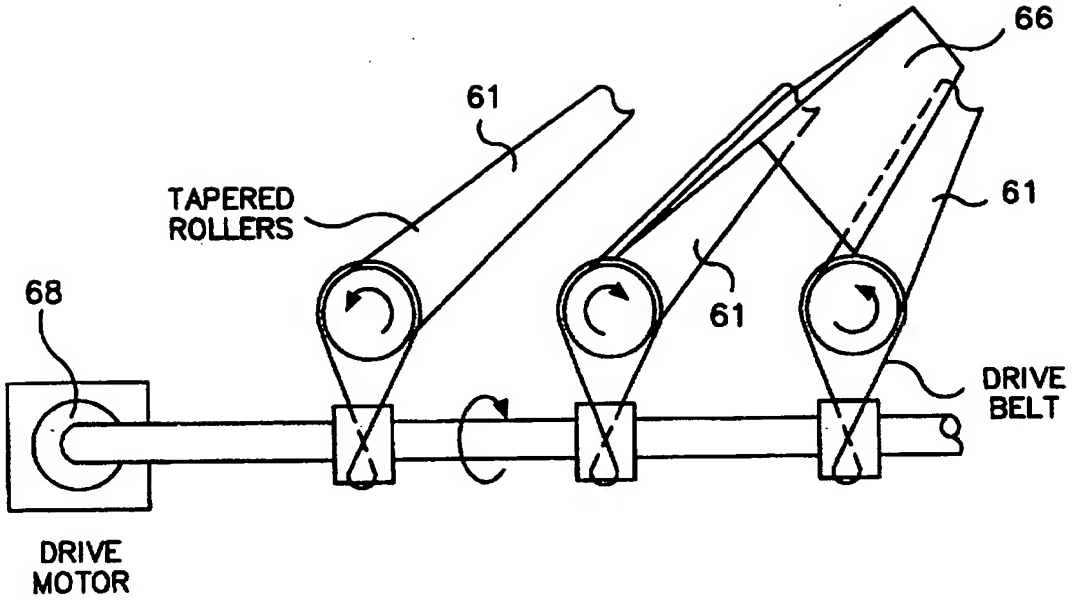


FIGURE 3C

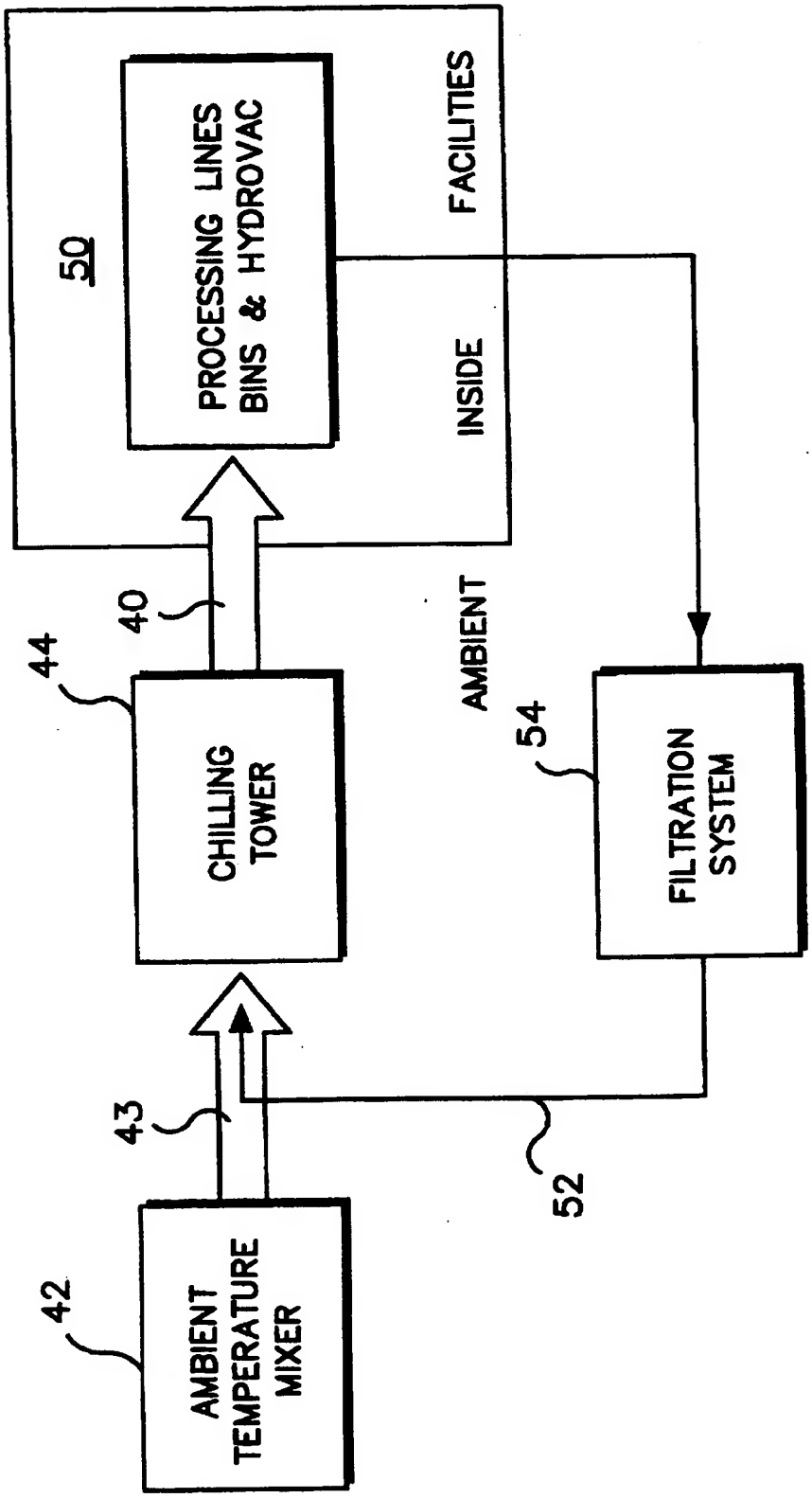

50
PROCESSING LINES
BINS & HYDROVAC
FACILITIES
INSIDE
AMBIENT
40
44
CHILLING
TOWER
54
FILTRATION
SYSTEM
43
52
42
AMBIENT
TEMPERATURE
MIXER

FIGURE 4

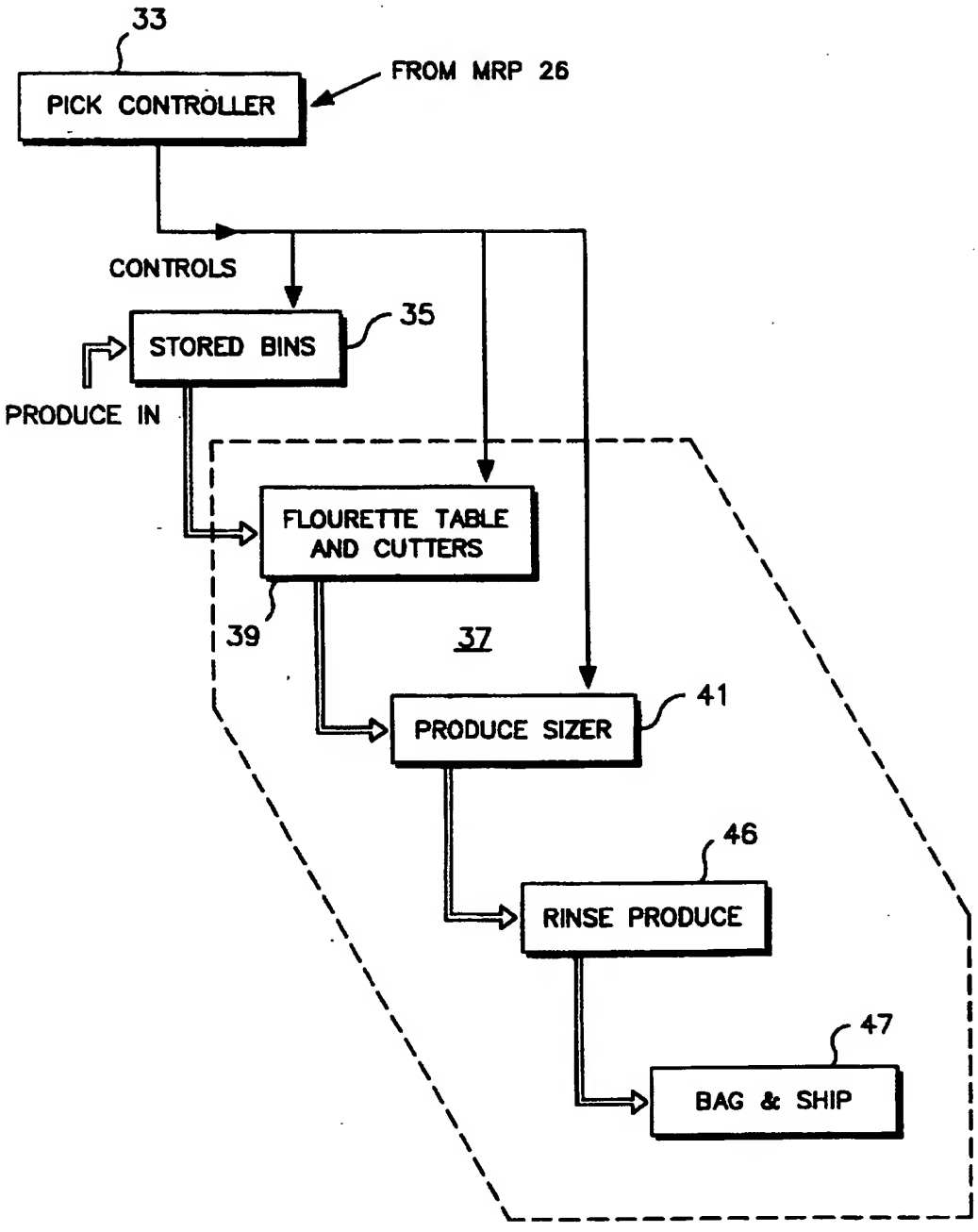

33
PICK CONTROLLER
FROM MRP 26
CONTROLS
35
STORED BINS
PRODUCE IN
FLOURETTE TABLE AND CUTTERS
39
37
41
PRODUCE SIZER
46
RINSE PRODUCE
47
BAG & SHIP

FIGURE 5

PROCESSING AND PACKAGING METHOD FOR COMBINED PRODUCE TYPES

FIELD OF THE INVENTION

This invention relates to equipment and processes for packaging fresh produce for extended shelf life, and more particularly to such equipment and processing which can be rapidly reconfigured and operated according to the requirements of the type of produce to be processed.

BACKGROUND OF THE INVENTION

Certain known methods of preparing farm-grown produce for transportation and marketing in approximately natural condition commonly include boxing or otherwise packaging the produce in the field from where harvested for shipment by refrigerated trucks to a transit terminal where the produce may be graded, sized and forwarded for wholesale distribution. Other known methods include gathering large volumes of common produce such as tomatoes, certain peppers, potatoes, and the like, into truck-mounted bins for transportation to produce terminals where minimum grading occurs prior to forwarding for mass crushing, peeling, and the like, of the entire bin of produce.

Such mass-volume methods for processing farm-grown produce typically expose the produce to diverse surrounding conditions of cold, heat, sun, wind, and rinse water that individually stimulate the produce to ripen more rapidly and more slowly, frequently beyond acceptable marketable condition. Thus, rapid processing, cold storage temperatures, swift transport mechanisms and procedures all contribute to prolonging the useful marketable life of produce made available in appealing condition to the ultimate consumer. However, it has been determined that subjecting certain produce the varying conditions of heat, cold, agitation, rinsing, and the like, in alternating combinations, or during insufficiently long intervals during successive processing conditions, can be detrimental rather than beneficial to the extension of useful marketable life of such produce.

SUMMARY OF THE INVENTION

Accordingly, the present invention incorporates substantially uniform environmental conditions in all processing of produce to obviate diverse stimulations of the ripening process in the produce being processed. Once chilled, the produce continues to be processed at correspondingly low temperatures throughout the sequences in the preparations for marketing, with significant improvements in useful marketable lifetimes, and with concomitant reductions in excessively ripened produce.

DESCRIPTION OF THE DRAWINGS

FIG. 1 is a pictorial diagram illustrating the overall operation of the present invention for improved shelf life of fresh produce;

FIG. 2 is a flow chart illustrating the sequence of processing steps according to the present invention;

FIGS. 3A, B, and C are, respectively, side, top, and perspective views of a sizer mechanism according to the present invention;

FIG. 4 is a block diagram of the water filtration and recycling system according to the present invention; and

FIG. 5 is a flow chart illustrating produce flow and control system for selecting and processing various combinations of different produce.

DETAILED DESCRIPTION OF THE INVENTION

Referring now to the pictorial diagram of FIG. 1, there is shown the overview of produce processing 9 in sanitary conditions 11 within a cooled environment 13 to assure extended shelf life and display for selection and consumption by customers and end-users.

Specifically, as illustrated in FIG. 2, produce is harvested 19 and provisionally inspected in the field and is transported by the farmer in field bins. These field bins are off-loaded from field trucks, for example, with the aid of fork-lifts, and placed onto conveyors, as the system infeed for transport to a flushing container such as a conventional HydroVac. The HydroVac receives the field bins of produce in sequence for flushing with water that is chilled and filtered to remove particulates and bacteria (primarily *e. coli*). This flushing 21 of the produce at a predetermined temperature (e.g. approximately 35° F. for broccoli, cauliflower, and the like) cleans the produce and gently lowers its overall temperature. The produce then completes the flushing cycle and is drained, and residual moisture is then vacuumed from the produce 23. In effect, the produce is thus initially chilled to retard the ripening process, or essentially is put to 'sleep'. The "dirty" water drained and vacuumed from the produce is cycled back into the filtration system for cooling and reuse on subsequent batches of produce to complete the loop of recycled water, as illustrated and described later herein with reference to FIG. 4.

The produce thus discharged from such flushing operations is directed into the cooled facility where further processing of the produce occurs at the reduced temperature (e.g., 35° F. and greater than 90% humidity throughout for broccoli, cauliflower, salad produce, and the like). Bins of produce are weighed and coded into the system via a bar code "tracking" label attached to each such bin. Each bin bar code is "scanned" for entry of the data into the inventory system 26 (e.g., manufacturing and resource planning system, or MRP). The bins are transported, for example, via lift truck or conveyors into the cooled storage system 25 which separates produce by produce Stock Keeping Units (SKU), and First-In-First-Out (FIFO) storage and retrieval demands. The FIFO storage system automatically indexes each bin toward a storage space in front for next-available selection and subsequent processing.

The requirements and details for production of an end product from the available produce are compiled in a pick list that is generated by the MRP system 26. The pick list in electronic controller 33 identifies the bin(s) of produce in FIFO storage 35 to be selected and transported via conveyor or fork-lift truck to the production system 37 including cutting tables 39, sizers 41, and the like, as illustrated in FIG. 5. The selected bin is "scanned" to signal the production system 37 which bin and associated produce contents is entering the processing system. The bin is deposited into a tank hopper at the front of a production "line". Each such line is set up with the flexibility to either run a specific product or a combination of products at various predetermined speeds, dependent upon product requirements (e.g., 12 feet per minute for broccoli slaw, or 38 feet per minute for spring salad, or 3 feet per minute for broccoli flourettes, or the like). An "infeed operator" (i.e., operator at the head of a line) scans the field bins to signal the MRP system 26 about the specific bin of field produce now starting to be processed by the line. This head line operator may view a displayed picture on the pick controller 33 of the end product to be produced, and press a button below the

selected end product to activate a computer which sets up the line or lines of infeed produce, and the requisite line speeds associated with the selected end product.

The tank hopper along the line immerses the field bin in water which includes chemicals from supply lines 40 at a cooled temperature of approximately 35 degrees F. Such chemicals as chlorine, sodium hydroxide, and citric acid may be included in the chilled water for prolonging shelf life of the produce. However, such chemicals tend to separate or not be soluable or not combine at the low temperature of the water. Therefore, the supply lines are sourced from an exterior mixing tank 42 (i.e., outside the cooled facility 50) which mixes water into a collection tank 42 at ambient temperature, above 35 degrees F. as illustrated in FIG. 4. The mixture of chemicals is pumped with recycled, filtered water 52 through a chilling tower 44 including a refrigerated chiller plate at a high rate of speed to lower the temperature of the mixture of water and chemicals, and this mixture is supplied 40 at the lowered temperature of about 35 degrees F. to the tank hopper. The water constantly circulates in the tank hopper and back into the filtration system 54 for an approximate 2-hour stability of the chemical mixture 43 for application to the produce that is being processed in order to prolong its shelf life.

The tank hopper gently tilts the produce onto in-feeding conveyor belts to operator tables in each production line. Such tables transport the produce to operators who cut, separate, select, and check for quality the produce being processed. A main operator at the head of the line chooses the end product to be produced from pictures displayed by the pick controller 33, as previously described. This information is converted into actions of the conveyors via a conventional programmable logic controller such as an Allen Bradley, Model OPTO 22SP which determines via preset routines the required line operations (e.g. the speed of the conveyor at about 12 feet/minute, the conveyor diverting the produce to the conical sizer 28 (explained later herein), the chemical and rinse cycles 30, 32 for about 11 seconds, and the like). This eliminates the requirement for highly skilled machinery operators, and facilities convenient reconfiguration of a line under computer control.

As illustrated in FIG. 2, the produce which has been identified for incorporation into the selected end product is cut, separated and selected, and may be transported to the "conical sizer" 41, or optionally to the bagging operation 47 shown in FIG. 5, or to a combining conveyor (which combines two or more types of produce in the correct mix to yield a product commonly referred to as a "medley pack").

The conical sizing operation, as described with reference to FIGS. 3A, B, and C, receives produce transported from a cutting/separating/selecting table along declined conical tapered rollers 61 which are mounted to provide progressively widening gaps between rollers, as illustrated in the perspective view of FIG. 3C, to facilitate grading by size of produce that can drop through the gaps at successive locations along the lengths of the rollers. A plurality of troughs 63 are arranged laterally to the rollers to collect in segregated arrays the produce of different sizes that drop through the gaps between rollers 61 at different locations therealong into such troughs 63. Tapered walls 65 are arranged above the adjacent tapered rollers that have peripheral surfaces rotating downwardly to inhibit pinching the produce between such rollers, as shown in FIGS. 3A, B, and C.

Specifically, such conical sizing mechanism allows for gentle separation of flourette produce (i.e. broccoli, cauliflower, and the like) utilizing powered rollers 61 and gravity. The produce to be sized is fed to the series of conical or tapered rollers 61 which are rotated in opposing directions (i.e. with the roller surfaces moving upward adjacent the tapering gap) to alleviate the possibility of pinching produce. The pitch or declination of the rollers 61 is altered by hydraulic lifters 65, and the speed of rotation is adjustable (accomplishing a higher throughput function) by the programmable logic controller that alters the speed of the drive motor 68. Specifically, the ends of the roller array may be raised and lowered by hydraulic lifts 65 positioned at the remote supporting ends of the rollers 61. The tapered rollers 61 are formed of substantially bio-inert materials such as stainless steel or other USDA approved materials (e.g. Teflon, and the like), and are spaced apart from each other to provide a progressively-expanding gap therebetween through which produce of specific sizes falls into the cross troughs 63 positioned in lateral array below and along the length of the rollers. Each line may include another cooling rise 46, as shown in FIG. 5, to clean the produce once again and maintain it at the desired low temperature.

The produce from a production line may be transported via conveyor onto a collector that gathers the produce for even distribution to a scale system which gathers the produce, weighs it, and discharges it in unit volumes or weighted quantities to a conventional bagging machine. The bagging machine includes a stainless steel chute or tube that feeds into an extruded tube of thin plastic sheet material (chosen specifically for the produce which has been processed) which is sealed below the quantity of produce discharged into the tube. This packaging scheme allows for the seal below the produce to become the final seal above the previous quantity of produce discharged into the tube. Individual, sealed bags are cut within the seal regions, are bar coded, and are guided onto a transport conveyor. This conveyor transports the bags onto a turntable for collection of bar-coded bags, which are scanned for identification and then packaged in preformed cases. The cases accumulate on a conveyor which places them on shipping pallets in a palletizing area. Another bar code may be generated in conventional manner and applied to the pallet to contain shipping information and information about the produce on the pallet. This pallet bar code is scanned to signal the MRP system 26 that the product has left the production environment 37 described above and is ready for shipment. All of the processing and packaging operations described above occur in the production environment 37 that is maintained at a reduced temperature of about 35° F. and about 90% humidity.

The pallets from the packaging operations previously described are transported into the shipping storage system 29 which also arranges the pallets of cases of bagged produce in FIFO manner. The bar code on each pallet may be scanned to facilitate automatic indexing of selected pallets to forward storage positions as available. The pallets are then loaded from forward storage positions into refrigerated trucks 31 that ideally are also operated at reduced temperature of about 35° F. and about 90% humidity in the cargo bay, and that can be sealed during loading to the interior of the building (also operating at about 35° F. and about 90% humidity) which houses the production environment 37. The bar-code scanner information regarding each pallet of produce thus processed, stored, packaged and loaded into a truck is then transferred as data to the information management system 26 for archiving as information in support of the responsibility for the produce thus shipped now residing, for example, with the trucking firm. This

entire process from initial chill rinse of the produce to truck-load shipment is performed at a temperature of not more than about 35 degrees F. and about 90% humidity in order to ensure a shelf life of the produce typically of about 30 days.

Therefore, the processing and apparatus of the present invention assures continued exposure of the produce being processed to an environment of reduced temperature which inhibits ripening of the produce and ensures longer shelf life after processing.

What is claimed is:

1. A method for improving the shelf life of harvested produce against decay and premature ripening, comprising the steps of:

reducing the temperature of the harvested produce to approximately 35 degrees Fahrenheit;

maintaining the produce substantially at the reduced temperature during processing subsequent to reducing the temperature of the produce;

temporarily storing, at substantially the reduced temperature and about 90% humidity, segregated volumes of selected types of the produce, for selection and subsequent processing;

selecting types of produce from storage for subsequent processing and packaging together for shipment at substantially the reduced temperature; and

transferring the packaged produce at substantially the reduced temperature to a mobile environment at substantially the reduced temperature for shipment to a remote location.

2. The method according to claim 1 wherein the step of reducing the temperature of the produce includes immersing the produce in water cooled to approximately 35 degrees Fahrenheit.

3. The method according to claim 2 wherein the water includes produce-preservative chemicals for enhancing the shelf life of the produce against decay, and the method includes draining the water and vacuuming residual moisture from the produce.

4. The method according to claim 3 wherein the water is retrieved subsequent to immersing the produce and is filtered and is combined with said produce-preservative chemicals for cooling substantially to the reduced temperature for subsequent reuse in immersing and cooling produce.

5. The method according to claim 1 wherein the step of storing includes accumulating the segregated volumes of selected types of produce for selection and subsequent processing substantially on a first-in first-out basis.

6. The method according to claim 1 wherein after the step of selecting types of produce from storage, the produce from storage is segregated according to approximate size for subsequent combination with other produce from storage in selected arrangements.

7. The method according to claim 6 wherein the step of segregating according to size includes using a sizer having a plurality of axially-aligned and space tapered rollers for providing progressively increasing spacing along the lengths thereof, and wherein said step of the method of segregating the produce according to approximate size is performed by rotating pairs of adjacent ones of the plurality of rollers to provide upward orientation of peripheral movement of adjacent rollers, and by supplying produce to be sized thereby along the lengths of the rollers to drop between adjacent pairs of the plurality of rollers against the upward orientation of the peripheral movement thereof for collection at selected location along, and at associated spacings between, pairs of the adjacent ones of the plurality of rollers.

* * * * *

US005316778A

United States Patent [19]

Hougham

[11] Patent Number: 5,316,778

[45] Date of Patent: May 31, 1994

[54] METHOD FOR PROCESSING LEAFY VEGETABLES FOR EXTENDED STORAGE

[75] Inventor: John K. Hougham, Carmel, Calif.

[73] Assignee: Global Prepcorp, Salinas, Calif.

[21] Appl. No.: 800,494

[22] Filed: Nov. 29, 1991

[51] Int. Cl.[5] A23L 1/025

[52] U.S. Cl. 426/324; 426/321; 426/326; 426/518; 426/615

[58] Field of Search 426/321, 324, 326, 615, 426/518

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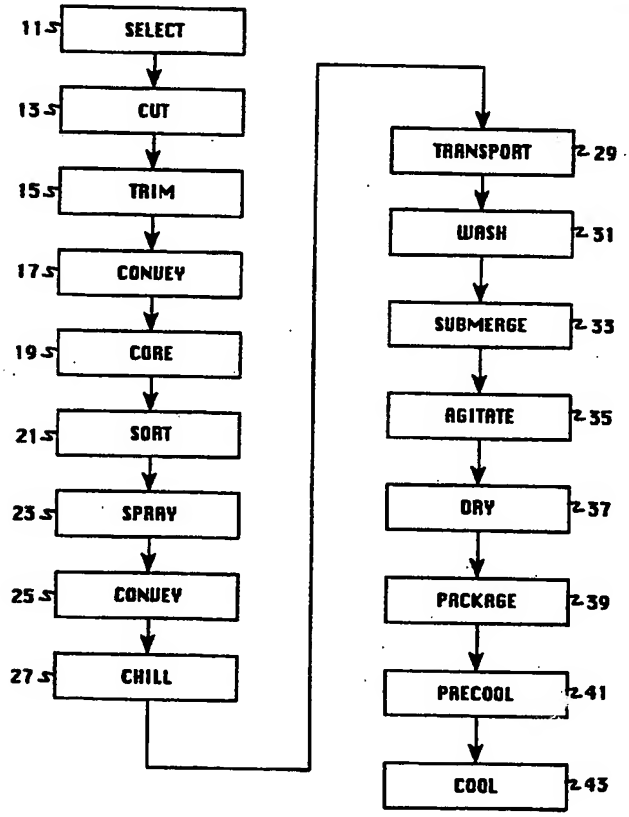
Primary Examiner—Helen Pratt

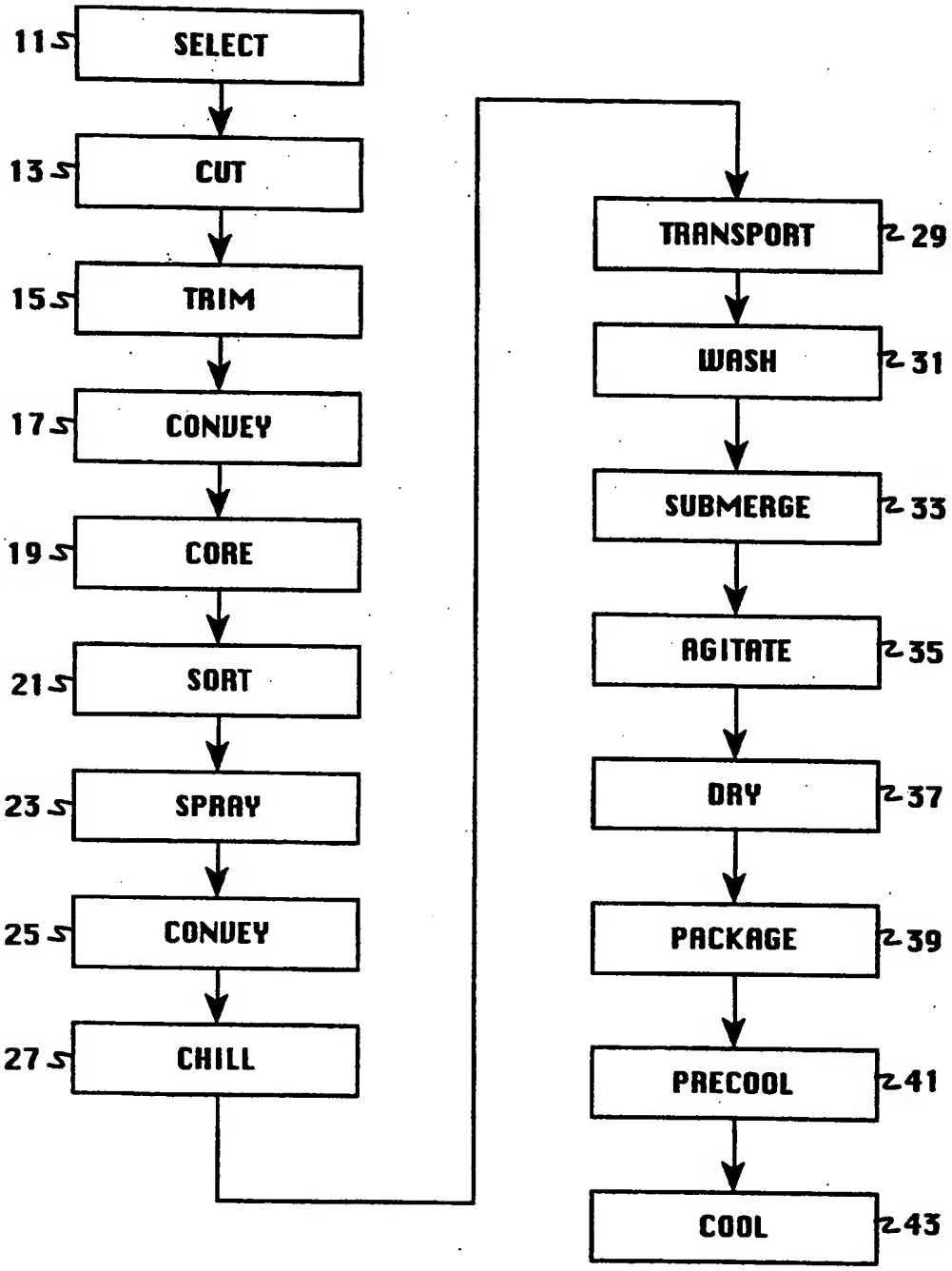
Attorney, Agent, or Firm—John S. Ferrell

[57] ABSTRACT

A method for processing common varieties of leafy vegetables to extend its storage life. The leafy vegetables are selected, cut, trimmed and conveyed to a processing area. During processing, the leafy vegetable leaves are torn rather than cut from the vegetable stems. Once cored, the leafy vegetables are washed in chlorinated water, dried and then chilled prior to final distribution.

20 Claims, 1 Drawing Sheet

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SUBMERGE
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AGITATE
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DRY
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PACKAGE
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PRECOOL
43
COOL

FIG. 1

METHOD FOR PROCESSING LEAFY VEGETABLES FOR EXTENDED STORAGE

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to the processing of leafy vegetables and more particularly to a method for the processing of leafy vegetables to produce an extended storage life.

2. Description of the Background Art

The expanded food service industry and consumer demand for prepared food product has had a significant impact on the fresh fruit and vegetable trade. For example, the prepared lettuce business for chopped, shredded and cored product now exceeds one billion pounds of pre-cut lettuce per year. Exacerbating the problem of meeting this huge demand for leafy vegetables is the fact that significant production yield decays or spoils before reaching the dinner table of the consumer. Part of this spoilage results from distribution difficulties which result from loading, transport and storage. Even routine shipping can cause extensive spoilage and economic loss with these short shelf-life products.

Spoilage of leafy vegetables occurs as a result of a variety of processes including microbiological decay, handling damage, and loss of cellular integrity with a consequential dissipation of cellular fluids. What is needed is a method of processing and treating leafy vegetables to mitigate spoilage.

SUMMARY OF THE INVENTION

In accordance with the present invention, a method is described which extends the storage life of processed fresh leafy vegetables. The method involves the selection, cutting, and trimming of leafy vegetables, using a tearing process to separate whole leaves from the stem. The removal of the leaves along intercellular boundaries limits cellular destruction of leaf tissue and thereby promotes an extended storage life. Once the leaf product is sorted, the vegetable leaves are sprayed with a water chlorine solution and refrigerated. After chilling, the leaves are washed using an overhead spray, a submergence bath and an agitation bath before drying, packaging, and final cooling.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a flow diagram of the vegetable processing method disclosed in the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now to FIG. 1, a flow diagram is shown outlining the steps of the processing method of the present invention. In step 11, the grower selects the product to be cut. The fields to which this process are primarily directed include first cut and re-cut harvests of leafy vegetables such as red, green, romaine and Boston (butter) and other leafy varieties. In steps 13 and 15 respectively, harvesting crews cut and trim the vegetable and place the product on a conveyer belt to be conveyed to a processing belt in step 17. Raw product is then handled or cored in step 19, wherein the leaves are torn from the vegetable stem.

The tearing of the leaves as opposed to cutting, is important to maintaining extended product freshness. As stated above, cutting vegetables generally results in significant cellular damage which in turn results in loss of cell fluids, and introduces the significant risk of rapid microbiological decay. By tearing the leaves, the cells are separated along interstitial boundaries rather than individually dissected. Furthermore, tearing the leaves from the stem may also result in the inclusion of residual stem tissue. This residual core tissue on the torn leaf is believed to further promote extended shelf life. As used in this specification, peeling is included as a method of tearing, since in order to peel a leaf, the leaf must be ultimately torn from the stem.

In step 21, sorting crews place the cored product from step 19 into coded baskets according to leaf size, quality or other discriminating features. For instance, the leaves from the heart of the plant are often segregated for separate processing designed for salad products. The lettuce leaves are then sprayed in step 23 with a solution of fresh water and chlorine consisting of approximately 100 parts per million of chlorine to water. Chlorine solutions ranging from 10 to 1000 parts per million can be used for this wash. This chlorine solution will remove any natural latex milky substance generated from the leaf. This wash will also add moisture to the leaf which adds to the shelf life of the vegetable. This first wash also tends to have an antimicrobial effect by creating a chemically hostile environment to bacteria and various fungal spores. In addition this first wash removes some of the dirt and debris which has accumulated on the product due to field handling.

In step 25, the full baskets are conveyed to an enclosed refrigerated van, which accompanies the harvesting machinery in the field. Refrigerated van temperatures are maintained at 32 to 52 degrees F. The baskets are palletized within the van and untimately moved to a processing facility in step 29. Upon arrival at the processing facility, the palletized baskets are placed on a conveyer belt and transported through an overhead wash system in step 31. Equivalently, the baskets may be submerged in a water bath in step 33 and agitated in step 35. This submersion and agitation act to remove insects, dirt and other debris which remains attached to the product following field processing. Both the overhead wash of step 31 and the submersion of step 33 utilize the chlorine water solution described above. Following the washing cycle, the leaves are dried in step 37. Drying can occur by methods of agitation, drip drying or by forcing chilled air across the surface of the leaves.

Packaging of the finished product occurs in step 39. Various packaging techniques are possible. The preferred packaging method includes a master container holding between 5 and 50 pounds of product packaged in sub-unit containers consisting of vented plastic bags. Various combinations of vented plastic bags and cartons have proven satisfactory for this application.

In step 41, the packaged product is palletized on 48×40 inch pallets and precooled to a temperature of 45 degrees F. or less. This cooling step can be implemented using vacuum cooling techniques or by exposing the packaged product to chilled air. Hydro-precooling using chilled water or washing solution prior to drying step 37 is also effective. The packaged product is then stored at a temperature of 32–45 degrees F. until ready for use.

The invention has now been explained with reference to specific method steps. Other variations on the preferred method will be apparent to those of ordinary skill in the art in view of this disclosure. For example, the

chlorine washing solution described above to clean and preserve the fresh vegetable product could be equivalently substituted by citric acid or various cleaning solutions prepared to produce the same result. Therefore it is not intended that this invention be limited, except as indicated by the appended claims.

I claim:

1. A method of processing leafy vegetables for extended shelf-life, wherein the method comprises:
tearing the leaves from the stem while including residual stem tissue with the leaves; and
packaging the leaves in a master container.

2. The method of processing leafy vegetables as in claim 1 further comprising the step:
placing the torn leaves in sub-unit containers prior to packaging in the master container.

3. The method of processing leafy vegetables as in claim 1 further comprising the first step:
harvesting the leafy vegetables from a field, wherein the harvesting further comprises the steps of selecting, cutting, and trimming the leafy vegetables.

4. The method of processing leafy vegetables as in claim 3 further comprising the step:
transporting the leafy vegetable in a non-cored form to a processing facility under refrigeration.

5. The method of processing leafy vegetables as in claim 3 further comprising the step:
transporting the leafy vegetable in its whole form to a processing facility at ambient temperature.

6. The method of processing leafy vegetables as in claim 1 further comprising the step:
sorting the torn leaves into coded baskets on the basis of discriminating features of the leaves.

7. The method of processing leafy vegetables as in claim 1 further comprising the step:
spraying the torn leaves with an aqueous chlorine solution having a chlorine concentration of between 10 and 1000 parts per million.

8. The method of processing leafy vegetables as in claim 1 further comprising the step:
chilling the torn leaves for field storage to a temperature ranging from 32 to 52 degrees F.

9. The method of processing leafy vegetables as in claim 1 further comprising the step:
washing the torn leaves in a wash system using an aqueous chlorine solution having a chlorine concentration of between 10 and 1000 parts per million.

10. The method of processing leafy vegetables as in claim 9 further comprising the step:
drying the torn leaves.

11. The method of processing leafy vegetables as in claim 1 further comprising the step:
holding and transporting the torn leaves under cooled conditions.

12. The method of processing leafy vegetables as in claim 11 further comprising the step:
maintaining the torn leaves in a cooled condition during the holding and transporting within a temperature range of 32 to 52 degrees F.

13. The method of processing leafy vegetables as in claim 1 further comprising the step:
submerging the torn leaves in an aqueous chlorine solution having a chlorine concentration of between 10 and 1000 parts per million, in order to remove insects, dirt and other debris.

14. The method of processing leafy vegatables as in claim 13, wherein following the step of submerging the torn leaves, processing further comprises the step of:
drying the torn leaves.

15. The method of processing leafy vegetables as in claim 13 further comprising the step:
agitating the submerged torn leaves to further effect the washing process.

16. The method of processing leafy vegetables as in claim 1 further comprising the step:
cooling the torn leaves to a temperature of 32–45 degrees F.

17. The method of processing leafy vegetables as in claim 16 wherein the cooling is achieved using vacuum cooling.

18. The method of processing leafy vegatables as in claim 16 wherein the cooling is achieved using chilled air.

19. The method of processing leafy vegetables as in claim 16 wherein the cooling is achieved using hydrocooling.

20. The method of processing leafy vegetables as in claim 16 wherein the cooling is achieved using ice.

* * * * *

US006112429A

United States Patent [19]

Mitchell et al.

[11] Patent Number: 6,112,429

[45] Date of Patent: Sep. 5, 2000

[54] **METHOD AND APPARATUS FOR WASHING AND DRYING HARVESTED VEGETABLES**

[75] Inventors: **Josh Mitchell; Stephen F. Griffin**, both of Monterey, Calif.

[73] Assignee: **Griffin Produce, Inc.**, Salinas, Calif.

[21] Appl. No.: **09/251,589**

[22] Filed: **Feb. 17, 1999**

Related U.S. Application Data

[63] Continuation-in-part of application No. 09/197,342, Nov. 20, 1998, Pat. No. 5,992,042.

[51] **Int. Cl.**[7] **F26B 5/08**

[52] **U.S. Cl.** **34/312**; 34/322; 34/58; 34/60; 34/209; 34/236

[58] **Field of Search** 34/58, 60, 62, 34/63, 202, 209, 236, 312, 318, 322, 328; 15/3.11, 3.12; 134/25.3, 72, 73, 74, 104.4; 426/302, 489, 506, 532; 99/489, 536, 623

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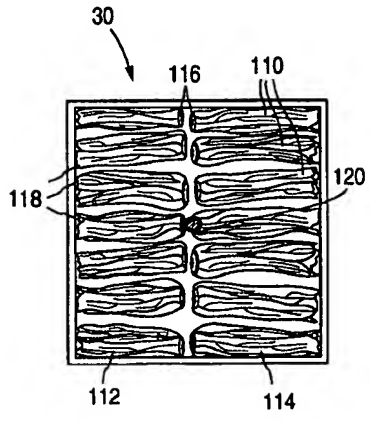
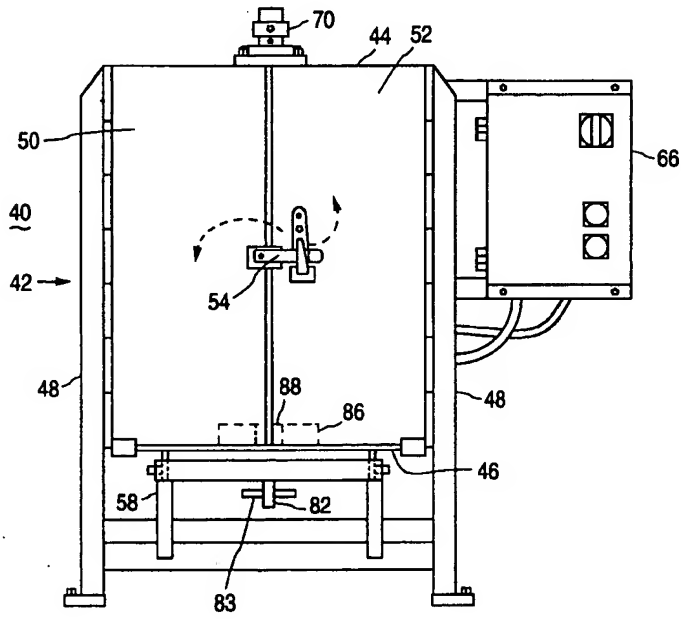
Primary Examiner—Pamela A. Wilson
Attorney, Agent, or Firm—J. William Wigert, Jr.; Crosby Heafey Roach & May

[57] **ABSTRACT**

A method and apparatus for processing whole head vegetables, characterized by a core end, and an open leafy end, is disclosed. Whole head vegetables pass through a washer which has a bottom belt which runs through the length of the washing line and passes through a first and a second tank (or more tanks) of cleaning water. Between the first and second cleaning tanks, a plurality of spray bars further clean the whole head vegetables. Top belts at each of the cleaning tanks above the bottom belt to secure the produce as it passes through the first cleaning tank and through the second cleaning tank. The lower belt, and the upper belts are controlled by a single speed control system resulting in less damage to the produce. Additionally, the angle of the belts conveying the produce through the two cleaning tanks is chosen for optimum performance. After the produce is washed, baskets, or totes, filled with the wet produce to be dried, are stacked vertically on a rotatable turntable assembly within an inner support frame. The totes are arranged with the open tops facing upwardly. A worker, to load the totes in the dryer, slides each tote within the inner frame with one on top of the other. The inner support frame has a top and bottom spindles or shafts which are rotationally supported by bearing structures at the top and bottom of the dryer. Moisture is driven out by centrifugal force when the inner support frame/totes are rotated.

17 Claims, 10 Drawing Sheets





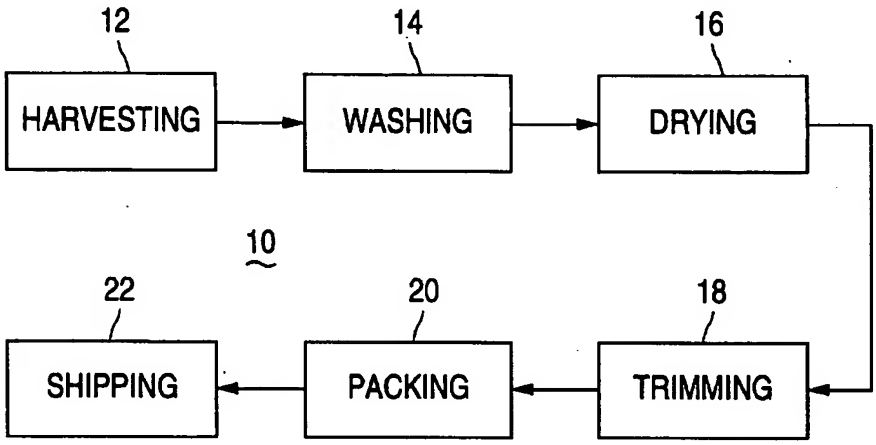


FIG. 1

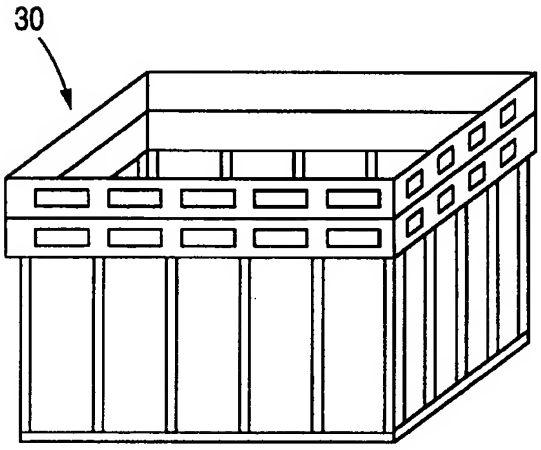


FIG. 2A

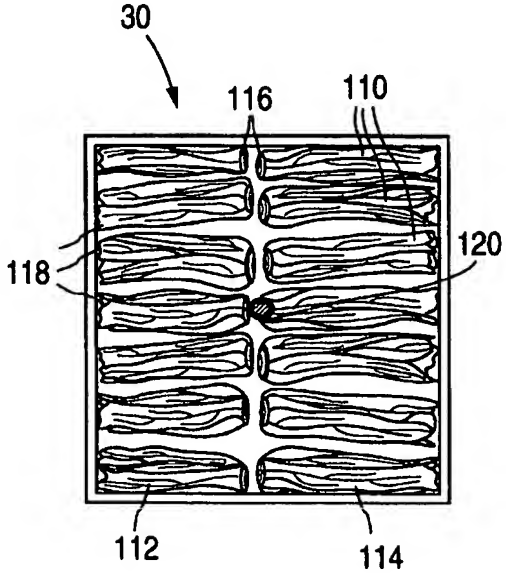


FIG. 2B

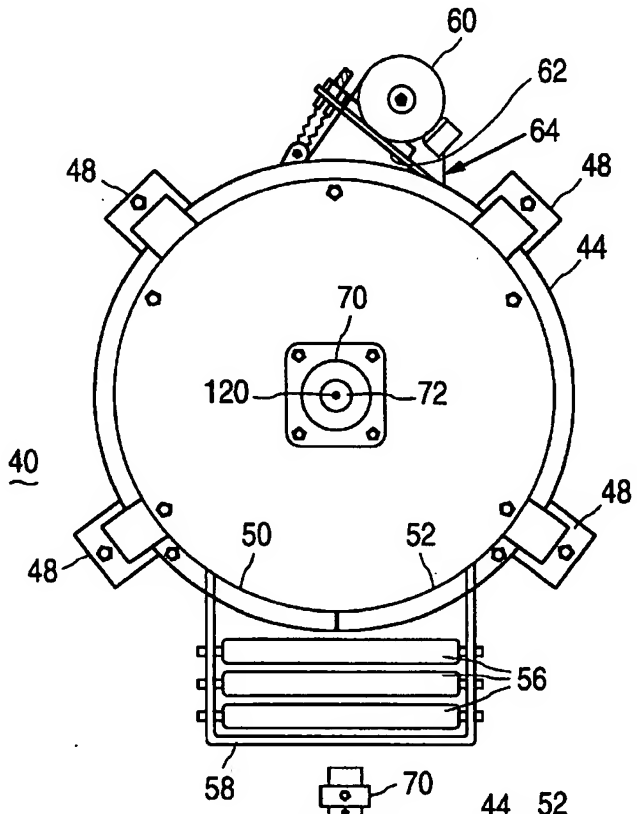

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FIG. 4

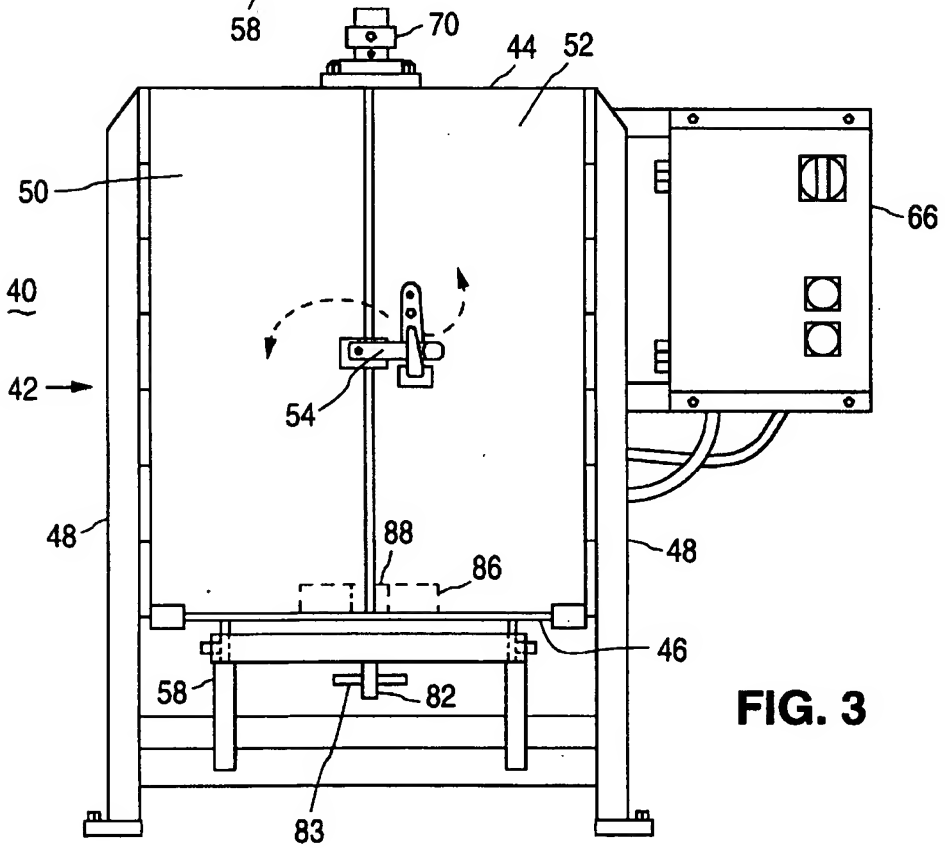
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FIG. 3

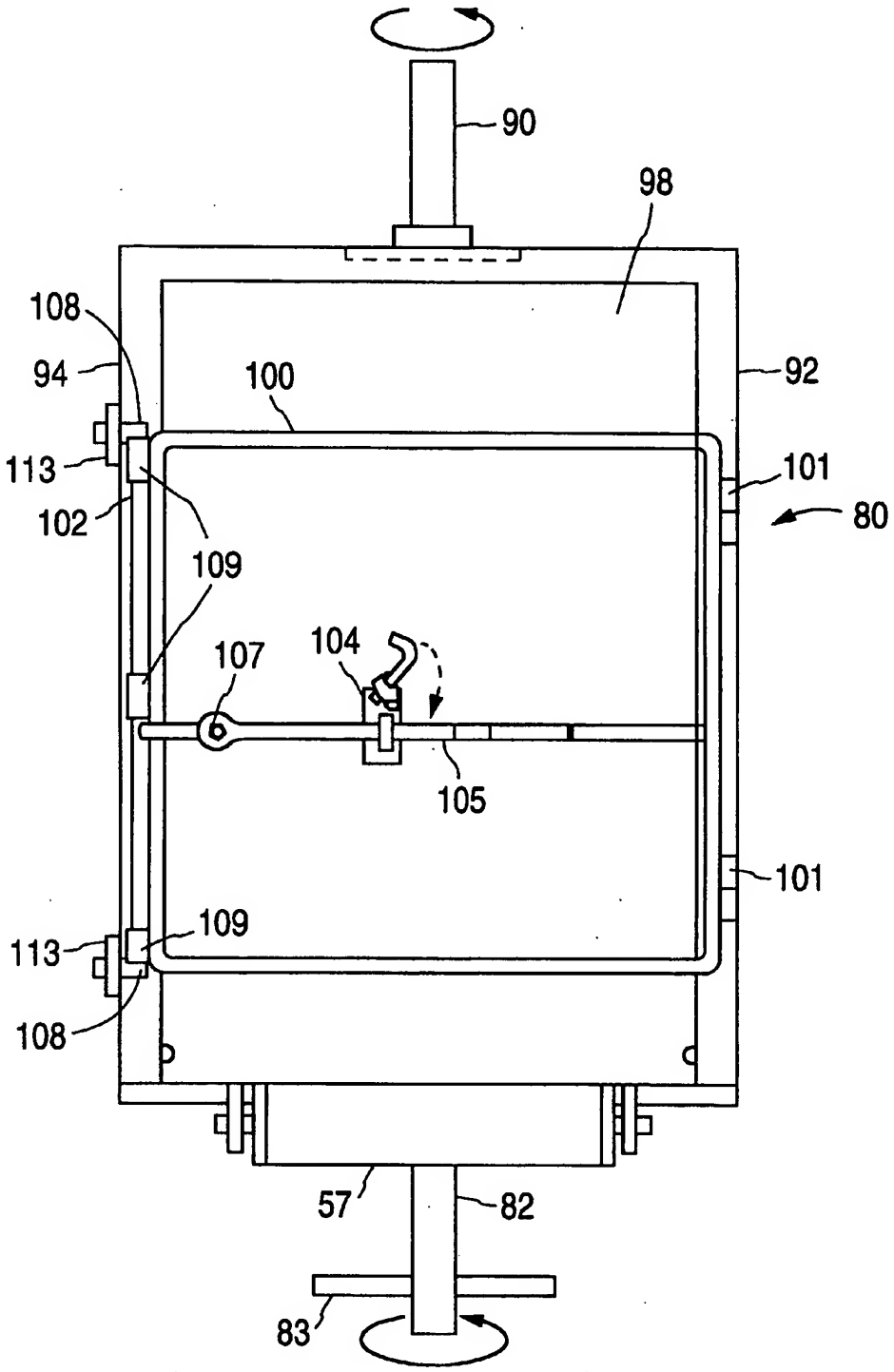
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FIG. 5

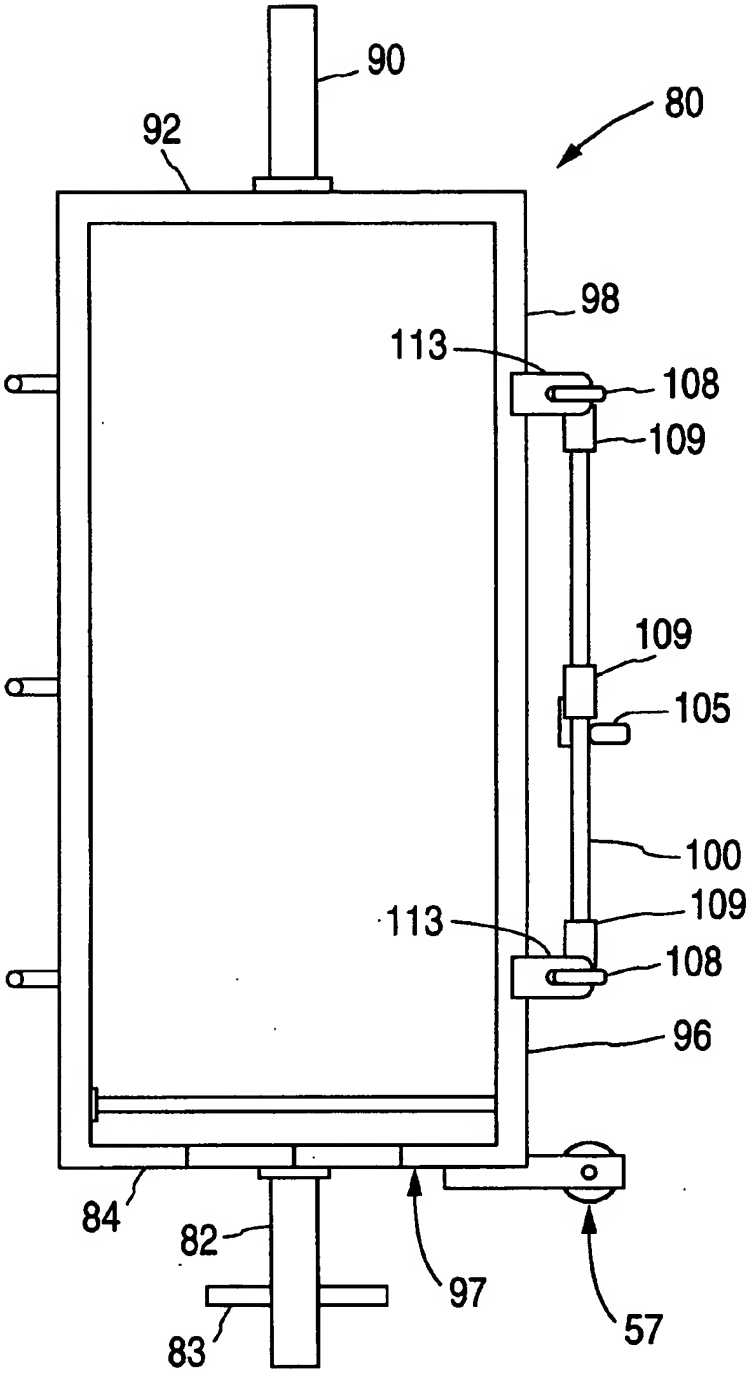

FIG. 6

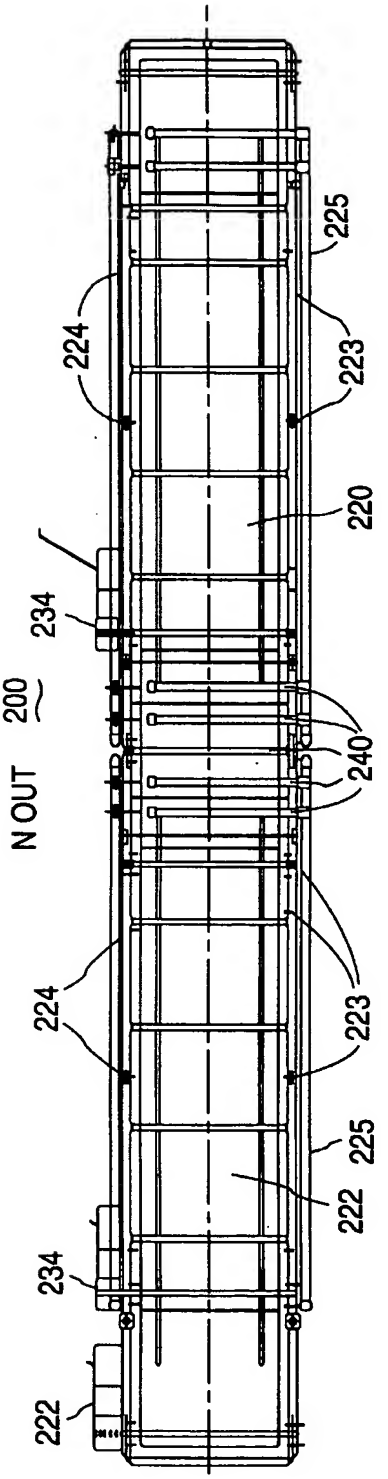
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FIG. 7A

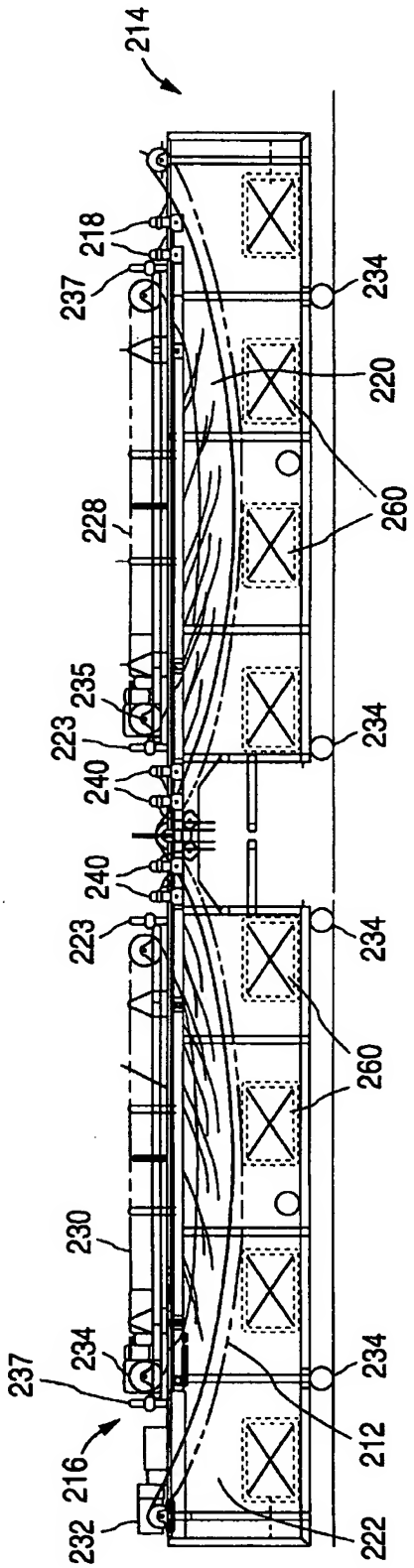
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FIG. 7B

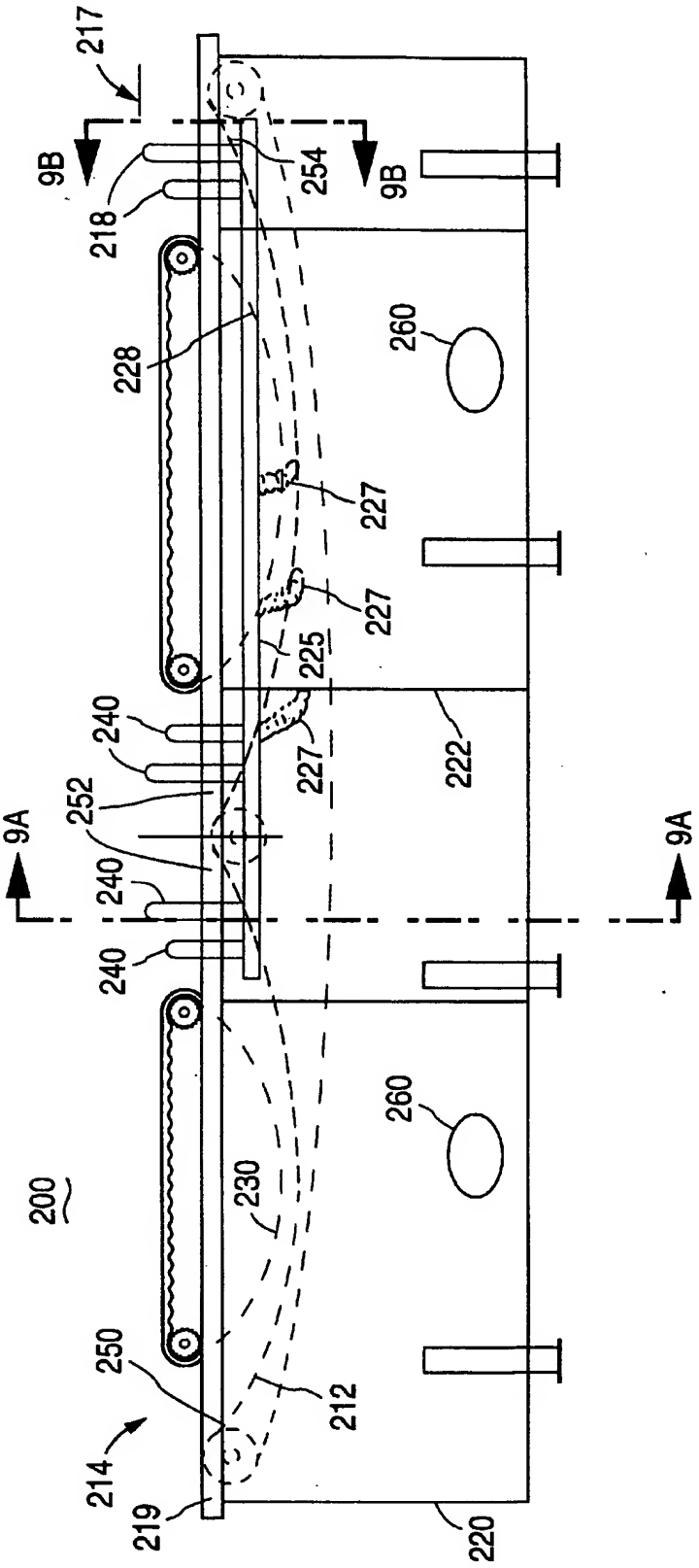
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FIG. 8

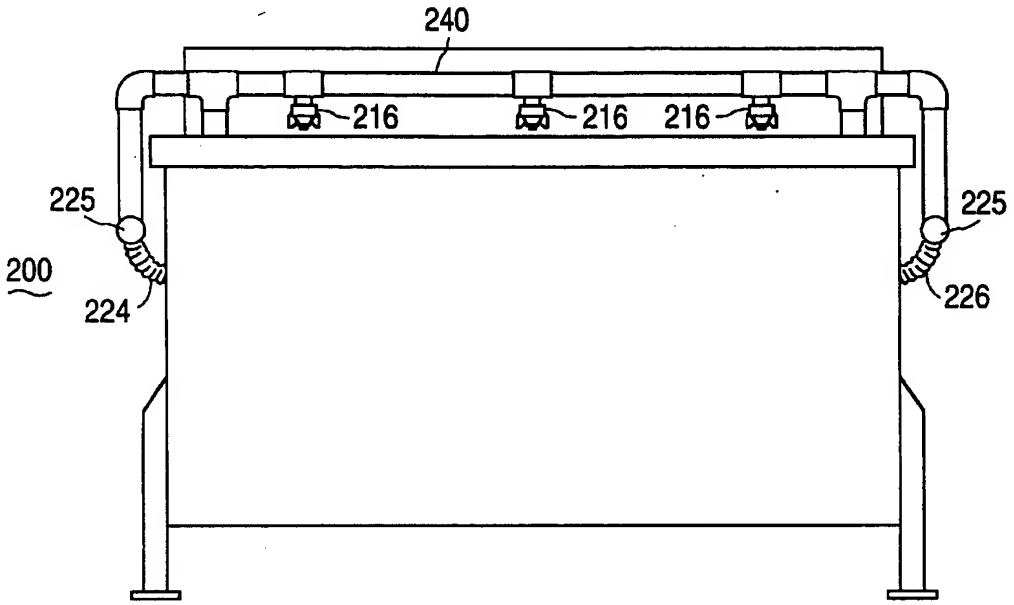


FIG. 9A

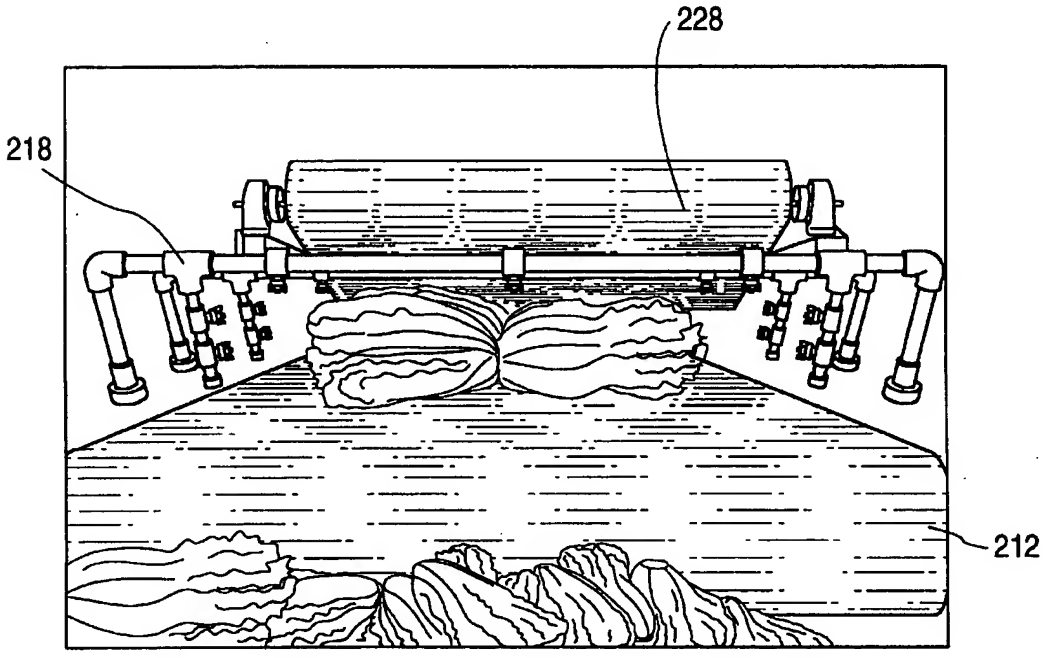


FIG. 9B

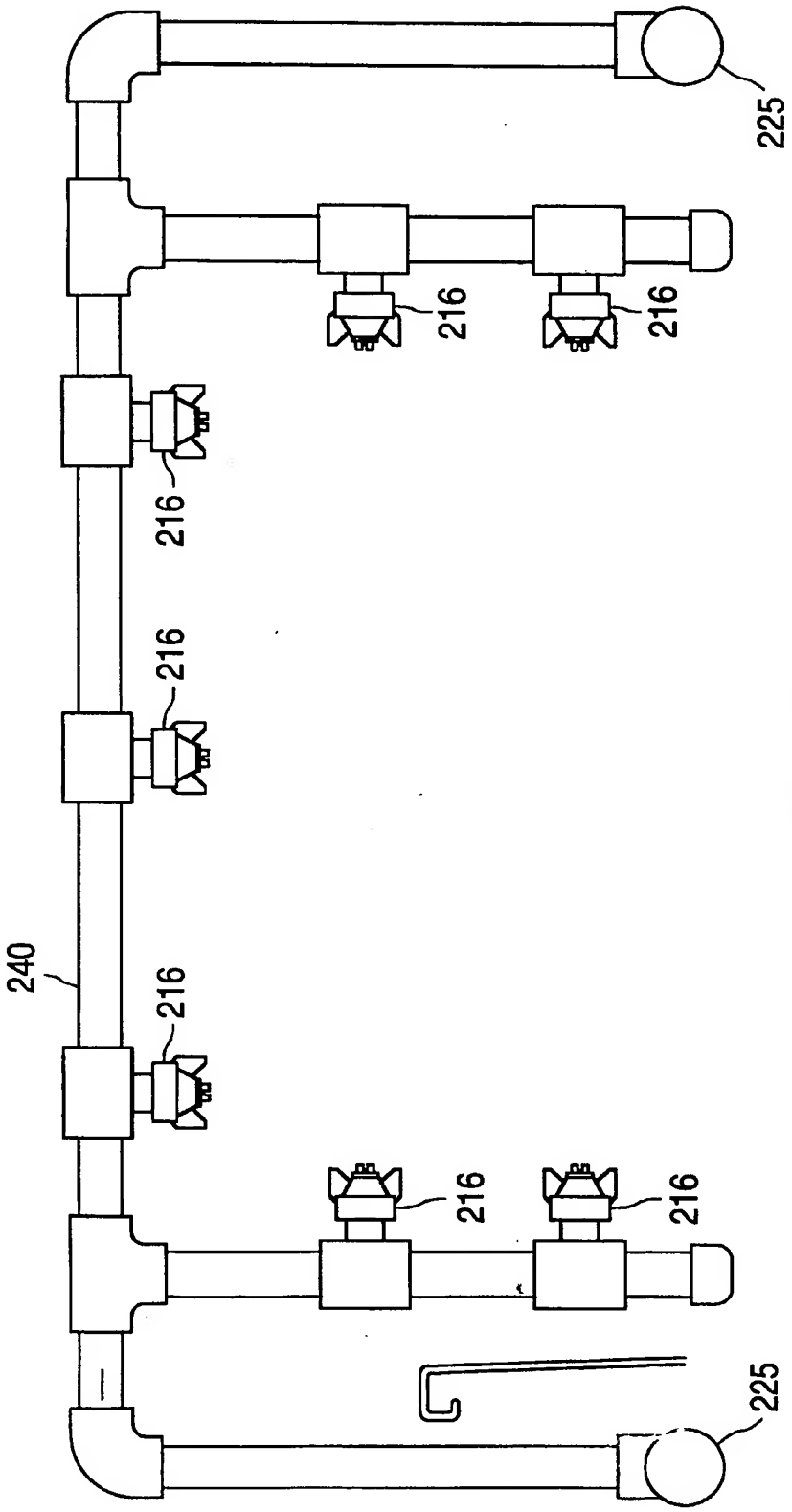


FIG. 10

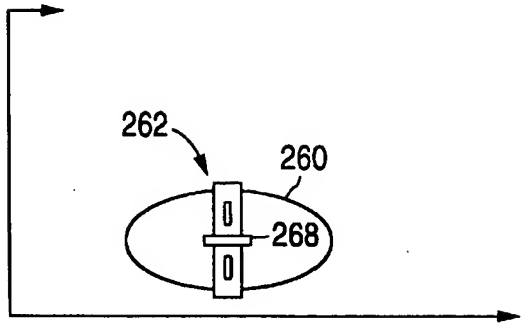


FIG. 11A

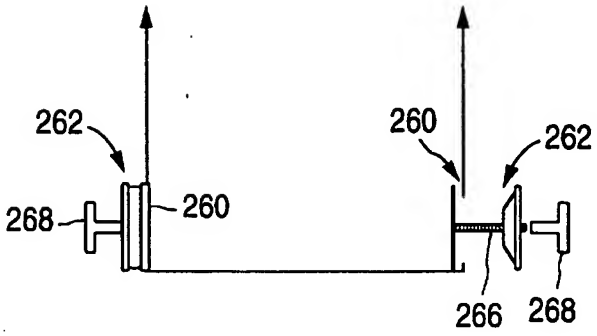


FIG. 11B

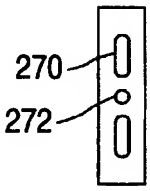


FIG. 11C

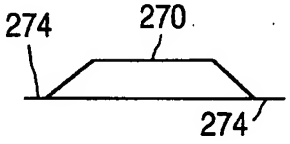


FIG. 11D

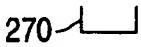


FIG. 11E

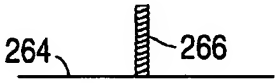


FIG. 11F

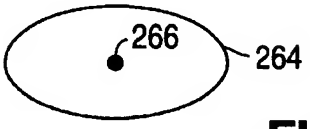


FIG. 11G

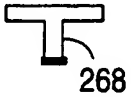
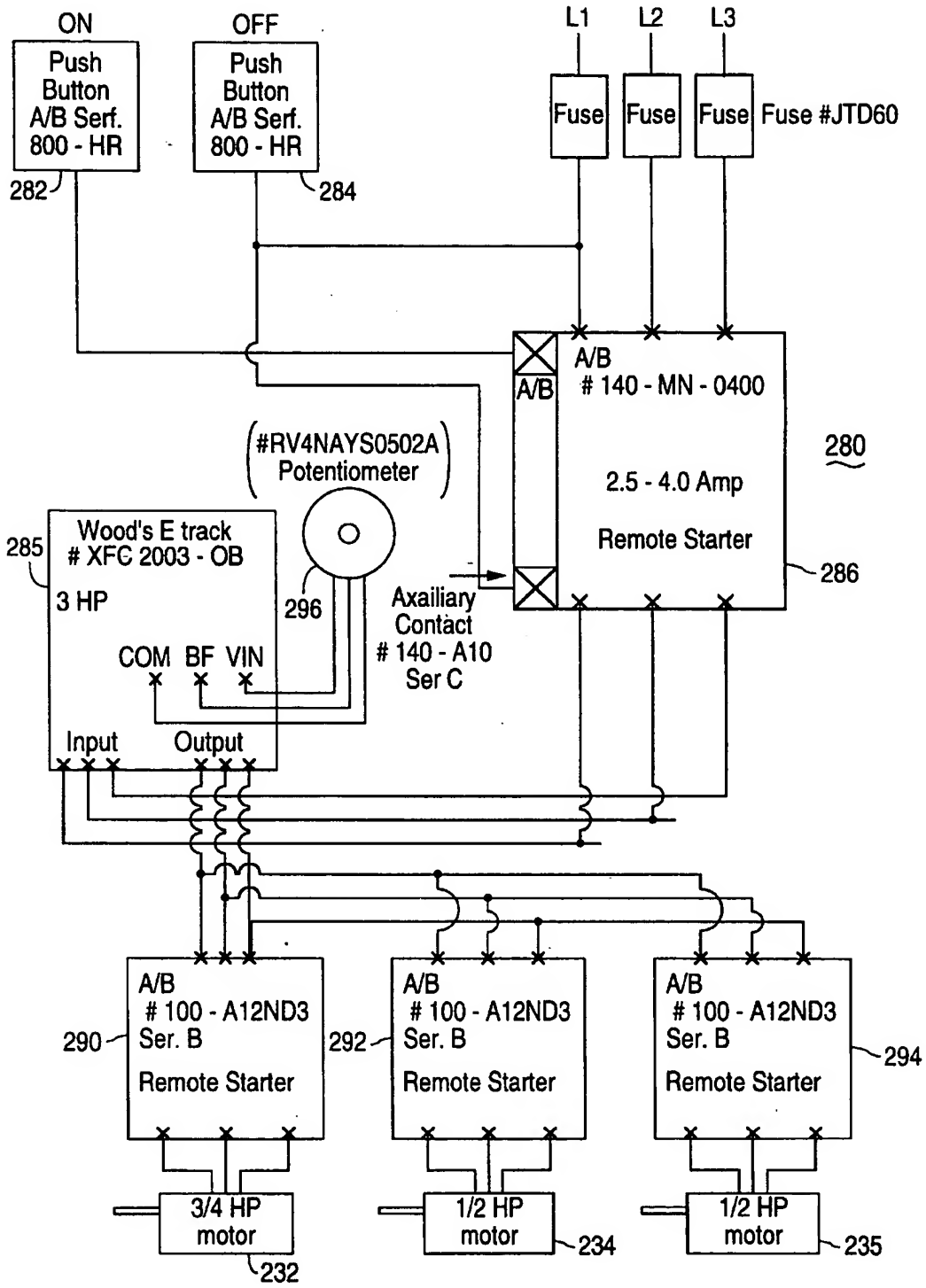


FIG. 11H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Fuse
Fuse
Fuse
Fuse #JTD60
A/B
A/B
140 - MN - 0400
2.5 - 4.0 Amp
Remote Starter
280
286
#RV4NAYS0502A Potentiometer
296
Wood's E track
XFC 2003 - OB
285
3 HP
COM BF VIN
Input
Output
Axailiary Contact
140 - A10
Ser C
A/B
100 - A12ND3
Ser. B
Remote Starter
290
A/B
100 - A12ND3
Ser. B
Remote Starter
292
A/B
100 - A12ND3
Ser. B
Remote Starter
294
3/4 HP motor
232
1/2 HP motor
234
1/2 HP motor
235

FIG. 12

METHOD AND APPARATUS FOR WASHING AND DRYING HARVESTED VEGETABLES

RELATED APPLICATIONS

This is a continuation-in-part application of co-pending patent application Ser. No. 09/197,342 entitled Improved Dryer For Drying Harvested Vegetables, filed Nov. 20, 1998, now U.S. Pat. No. 5,992,042 assigned to the same assignee as the present application.

FIELD OF THE INVENTION

The present invention relates to washing and processing produce such as lettuce, leafy vegetables and the like, and in particular to whole head vegetables.

RELATED ART

In the field produce such as lettuce, leafy and other vegetables, are harvested both by hand and by mechanized equipment. Produce cut in the field is often put into, transported, and stored in containers or baskets, often referred to as "totes". Typically, theses totes are made of plastic, are constructed to have multiple openings in the sides and bottom, and are open at the top where the produce is put into the tote.

The harvested produce is transported to a production facility where, among other things, the produce is washed, dried, weighed, trimmed, packaged and shipped. During the washing phase produce is typically emptied from the individual totes and washed in bulk. Afterwards, the produce must be dried before the remaining steps. In some drying operations, the produce is dried in bulk. But it is convenient if the produce can be re-introduced into standard totes for drying and subsequent processing.

SUMMARY OF THE INVENTION

In accordance with the present invention, a method and apparatus for processing whole head vegetables, characterized by a core end, and an open leafy end, is set forth. In particular, whole head vegetables pass through a washer which has a bottom belt which runs through the length of the washing line and passes through a first and a second tank of cleaning water. Between the first and second cleaning tanks, a plurality of spray bars further clean the whole head vegetables. Top belts are also provided above the bottom belt to secure the produce as it passes through the first cleaning tank and through the second cleaning tank.

In accordance with another aspect of the invention, the lower belt, and the upper belts are controlled by a single speed control system. Since the belts are thus not individually controlled there is no possibility that there the belts can run at different speeds, which can result in damage to the produce. Additionally, the angle of the belts conveying the produce through the two cleaning tanks is chosen for optimum performance.

The totes are arranged with the open tops facing upwardly. A worker, to load the totes in the dryer, simply slides each tote within the inner frame with one on top of the other. The inner support frame has a top and bottom spindles or shafts which are rotationally supported by bearing structures at the top and bottom of the dryer. Moisture is driven out by centrifugal force when the inner support frame/totes are rotated.

In accordance with another aspect of the invention, a method and apparatus for washing and then drying produce, such as whole head lettuce characterized by having a core or cut end, and an open leafy end, is provided. Such produce is sometimes referred to as whole head lettuce or whole head vegetables. Such produce is normally washed and dried manually rather than mechanically. In accordance with this aspect of the invention, such types of harvested whole head vegetable produce, after being washed, is loaded into one or more individual baskets or totes.

In the preferred embodiment of the invention, one or more totes are filled with produce having a cut end and an open, leafy end after washing. Preferably a plurality of totes are stacked and secured in a rotatable manner within a mechanical dryer. The stack of totes, which are rectangular in shape, are centered on or near the rotational axis within an inner frame or framework. The frame is provided with top and bottom spindle shafts which are supported in bearing supports. The inner frame is rotated so that moisture in the produce is centrifugally forced out of the produce.

In the preferred embodiment, produce such as whole head vegetables are arranged in a preferred manner in the totes for the drying operation. Specifically, rows of produce are arranged in the totes with the cores or cut ends of a row of produce juxta positioned with, or "butted" against, the cut ends of another row, with the leafy ends generally pointing away from the axis of rotation. In this position, water or moisture tends to flow outwardly from the leafy open ends when the inner frame is rotated.

The foregoing and other objectives, features and advantages of the invention will be more readily understood upon consideration of the following detailed description of certain preferred embodiments of the invention, taken in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a flow chart for processing harvested produce such as lettuce and other leafy vegetables.

FIG. **2A** is a perspective view of a standard basket or tote used to transfer harvested vegetables and FIG. **2B** is a top view of a tote loaded with a vegetable such as whole head vegetables.

FIG. **3** is a front elevation view of a dryer in accordance with the present invention.

FIG. **4** is a top view of the dryer of FIG. **3**.

FIG. **5** is a front elevation view of the inner frame of the dryer of FIG. **3**.

FIG. **6** is a side view of the inner frame of FIG. **5**.

FIG. **7A** is a top view, and FIG. **7B** is a side view of the improved produce washing machine of the present invention.

FIG. **8** is a simplified side view of the washer of FIG. **7C**.

FIG. **9A** and FIG. **9B** are cross sectional views of the washer of FIG. **8**.

FIG. **10** is a detailed diagram of one of the plurality of spray bars.

FIG. **11A** is a front view and FIG. **11B** is an end view of a cleaning tank showing cleaning ports; FIG. **11C**, FIG. **11D** and FIG. **11E** are top, side and end views respectively, of the bracket of the door mechanism of the present invention; FIGS. **11F** and **11G** are side and top views, respectively, of the sealing plate of the door mechanism; and FIG. **11H** is a plan view of the door mechanism handle.

FIG. **12** is a block schematic diagram of the conveyer speed control system of the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

FIG. **1** is a flow diagram **10** for processing harvested produce such as lettuces, leafy vegetables, whole head and

other vegetables, which will sometimes, collectively be referred to as "produce". By "leafy vegetables" it is meant that family of specialty lettuces and other leafy greens which, when mixed together for sale and consumption are sometimes referred to as "spring mix," "mixed greens," or "baby greens." For example, this includes lettuces, such as green romaine, red romaine, sierra, lola rosa, tango, green leaf, red leaf, little gem, red butter, read oak, red perella and green perella. It also includes greens such as arugula, mizuna, red mustard, green mustard, spinach, tatsoi, red chard and red russian kale.

After the produce is harvested, as indicated at **12**, the produce is sent to a plant for processing. This is typically accomplished by transporting the produce in standard baskets frequently referred to as "totes". FIG. **2A** is a perspective view of a standard basket or tote **30** used to transfer harvested vegetables and FIG. **2B** is a top view of a tote loaded with vegetables, such as whole head vegetables, as an example. In the plant the produce is either processed or cooled in a vacuum tunnel and then stored for a short period of time, up to two days.

The produce is then unpacked from the totes and washed in a produce washing machine. The next step **16** is to dry the moist produce. As explained above, some drying machines dry the produce in bulk, while others, such as that shown in U.S. Pat. No. 5,675,905, dry the produce while the produce is stored in totes. Mechanically washing some kinds of vegetables, such as whole head lettuce and other vegetables is difficult to dry mechanically. After drying, the totes are delivered to stations for trimming, if necessary, as indicated at **18**. Any damaged or broken leaves are also removed. For whole head products the core is removed or trimmed. After weighing, the trimmed produce is then packed as indicated at **20**. Produce is frequently packed in plastic bags or in cardboard boxes. At this point the produce is ready for shipment, as indicated at **22**.

FIG. **3** is a front elevation view, and FIG. **4** is a top view, of a dryer **40** in accordance with the present invention. The dryer **40** has an outer body **42** having a top **44** and a bottom **46**. Body **42** is supported by legs **48**. A pair of doors **50** and **52** close an opening in the front of outer body **42**. The doors are provided with a suitable latching mechanism **54**. The doors are open when the dryer is being loaded and closed during a drying operation. A plurality of first rollers **56** are mounted by a bracket **58** to the dryer **40**. Rollers **56** facilitate the loading of dryer **40** with a stack of totes **30**.

Rotation of the produce-carrying totes **30** is accomplished by the use of a motor **60** attached by a support structure **62** to dryer **40**. The motor is provided with a coupling device, such as a V-belt, or preferably, a cleated belt **64**. The motor drives rotates the inner body **80** (FIGS. **5** and **6**) and the enclosed totes **30**. This is accomplished by coupling the cleated belt **64** to a pulley **83** attached to the lower spindle shaft **82** (FIGS. **5** and **6**).

A control panel **66** is provided for controlling the operation of dryer **40**. A conventional inverter and timer are provided within the control panel **66** to control the duration and revolutions per minute. It is important that the dryer dry the produce thoroughly by turning at an adequate speed, for an adequate period of time, while preventing excess mechanical damage from drying the produce too vigorously. The duration, and speeds of rotation must be empirically determined for each type of produce being dried.

A spindle shaft support **70** is provided at the top of outer body **42**. A bearing **72** is provided as a part of support **70**. As will be explained below, support **70** anchors and permits rotation of the inner frame containing the totes.

FIG. **5** is a front elevation, and FIG. **6** is a side view of the inner frame **80** of the dryer of FIG. **3**. Inner frame **80** both supports and secures a stack of totes filled with produce during the drying operation. A lower spindle shaft **82** is connected to the bottom **84** of the inner frame. Spindle shaft **82** is supported by spindle support structure **86** having a central bearing **88** (FIG. **3**). An upper spindle shaft **90** is attached to the top **92** of inner frame **80**. The shaft **90** is rotationally supported by spindle shaft support **70** and bearing **72** (FIGS. **3** and **4**) on dryer body **42**. A second roller assembly **57** is connected to the inner frame **80** and is aligned with the first roller **56** assembly to facilitate the placement of totes within the inner frame. Rollers **56** and **57**, in one actual embodiment, have a 2 ½ inch diameter and are made of stainless steel.

Inner frame **80** has three sides **92**, **94** and **96** and a front opening **98** through which the totes **30** are inserted. It also has a bottom **97** which supports the totes. Bottom **97** is made of ½ inch plate steel, in one actual embodiment. While the totes, preferably, are first stacked and then inserted within inner frame **80**, they can be inserted and stacked individually. A door **100** is rotatably attached to the inner frame by a hinge assembly **101**. When the door is closed, it completes the enclosure of the stack of totes.

The inner door latching mechanism operates as follows. To open the door, a latch **104** is pivoted upwardly. This allows the operator to pivot lever **105** upwardly about pivot hinge **107**. Vertical shaft **102** is held in place by three guide sleeves and is terminated at each end by hooks **108** which, when the door is closed, are engaged by securing eyes **113**. When the operator rotates vertical shaft **102** about its axis this unhooks hooks **108** from securing eyes **113**. In this position the door may be opened, pivoting about the hinge **101**. The process is reversed to close and secure door **100**.

The inner frame preferably is made of stainless steel. In one embodiment the frame is formed by 1 ¼ inch channels and the door is formed by ½ inch diameter tubing. The outer body **42** is made of stainless steel sheet metal.

Referring to FIG. **2B**, it has been found that when drying whole head vegetables **110**, there is a preferred way to place them in the totes **30**. First and second rows **112** and **114** are formed with the cut or core ends **116** generally abutted or juxta positioned to each other with the leafy ends **119** facing outwardly, relative to the axis of rotation **120**. Of course, the totes **30** are filled in layers of rows to fill them. It should also be understood that filling the totes in an actual production facility does not require a high degree of precision so there is no requirement that individual heads precisely abut each other.

Referring to FIGS. **7A** and **7B**, FIG. **8** and FIG. **9**, an improved washing machine **200** for washing produce, including whole head vegetables as shown. While any type of produce can be washed with the improved washer and method of the present invention, for purposes of this description, washing and drying of whole head vegetables will be described. As explained the whole head vegetables, after being harvested, are shipped to the plant first to be washed. The whole head vegetables are unpacked from the totes and loaded, in one to four rows, on an intralox type dewatering or lower belt **212** at the entry end **214** of the washing machine **200**. Note the entry end of the washer **200** in FIGS. **7A** and **7B** is opposite to that in FIG. **8**.

When placed on the dewatering belt, the produce, or product, is oriented with the core facing the centerline of the lower belt as shown in FIG. **9B**. With this orientation the open ends of the whole head vegetables face cleaning jets

216 on a pair of entry spray bars 218. The dewatering belt 212 then runs down into and through the first of two water filled cleaning tanks 220 and 222 having a horizontal surface 219. The first tank 220 is cooled by the addition of chilled water to a temperature of 35–50 degrees F. The second tank 222 is cooled, by recirculating the water through a chiller (not shown), at a temperature of 33–40 degrees F. This differential avoids causing thermal shock in the product by cooling it gradually. Desirably, the cleaning tanks are made of stainless steel. For convenience the tanks may be mounted on casters 234. Access to the inside of the tanks 220 and 222 is through ports 260 as described later.

When the produce passes on lower belt 212 through the cleaning tanks 220 and 222, the produce is cleaned by turbulence caused by two rows of water jets 223 and 224 along each side of each tank which spray inwardly. One row is oriented slightly above the belt 212 and the other slightly below, while both are aimed at the center line of the product as it travels by. A pipe manifold 225 passes water via flexible tubing 227 to the water jets 223 and 224.

The produce is prevented from floating or "bobbing" in the water while submerged by means of a first dewatering top belt 228 and a second dewatering top belt 230. Each top belt 228 and 230 runs the length of one cleaning tanks 220 and 222, respectively, above or at the water level. The height of the belts is adjustable. Posts 237 are threaded, and by adjusting their position, adjusts the frame 1 to the belt. This is to accommodate different size products. The product then exits the first tank 220 at the end of its run as the bottom belt 212 travels up and over the lip of the first tank 220 and down into and through the second tank 222. It should be understood, however, that more than two cleaning tanks may be utilized as required.

The lower belt is driven by a ¾ horsepower motor 232 and each of the upper belts is driven by /2 horsepower motors 234. These motors are under the control of the speed control system of the present invention as explained in connection with FIG. 12.

In accordance with the present invention, between the two tanks 220 and 222 is a plurality of additional spray bars 240. Each spray bar 240 is provided with a plurality of quick tee jets 216. See, in particular FIGS. 9A, 9B and 10. The spray bars can be made from ¾ in. PVC. Cold water is provided via manifold 225 by a re-circulatory motor (not shown). With jets 226 positioned above and along side of the produce, there is sufficient coverage to rinse the produce from above, and from the side, and to penetrate the head of the vegetable. Afterwards, the product moves into the second tank 222. The second upper belt 230 keeps the product under the water, while it is cleaned by a duplicate jet system as in the first tank 220. The whole head product is then picked from the belt at its terminus 216 and loaded back into totes where it is delivered to dryer 40 described above.

Water is pumped into the cleaning tanks by pumps (not shown). It has been found that the use of a mesh screen at the inlet of the recirculating pump prevents stray leaves from being sucked in. The screen must be wide enough to span the width of the tank. It can be hinged to allow pivoting for cleaning.

Important to successful washing of the produce is to maintain the angle of the lower de-watering belt at optimum angles. If the angle is too shallow the product is not effectively washed. If the angles are too steep, the product will "skid" on the way into each cleaning tank and may not be able to "climb" back out. The angles also depend upon the product being washed. For example of a hearts line, a small line, the ideal entry angle (relative to horizonal surface 229 is −20 degrees at the start 250, −18 degrees at the middle 252, and −20 degrees at the finish 254. For a big line for larger products, the angles are −27 degrees at the start, −25 degrees in the middle, and −27 degrees at the finish.

Referring to FIGS. 11A–11C, in accordance with another aspect of the invention, clean out ports 260 are provided for cleaning tanks 220 and 222, as shown in FIG. 8 and FIG. 11A–FIG. 11C. When the door assembly 262 is opened a hose can be inserted within the cleaning tanks and any debris can be removed. Normally, this is done on a daily basis.

Any number of clean out ports can be provided. In FIG. 11B two ports 260 are shown, with the door assembly on the left shown in the sealed or closed state. The door assembly 262 on the right is shown in an exploded view. FIGS. 11C–11H shows the door assembly in greater detail. Port 260 is sealed by an elliptically shaped sealing plate 264 which is larger than the port 260 and fits within the cleaning tank. Affixed perpendicularly to the sealing plate is a threaded rod 266, which in the preferred embodiment has a ⅝ in. thread. A T-shaped handle 268 is female threaded to engage the threaded rod 266.

A bracket 270 is provided with a hole 272 in its center through which passes the threaded rod 266. Bracket 270 is channel shaped as seen in FIG. 11E. It also is provided with lips 274 which engage the edge of port 260 when the handle is screwed down. Bracket 270 serves to provide tension when the handle is screwed down to seal the door. The water in the cleaning tanks must be removed before the doors 262 can be opened because water pressure on plate 264 seals the door tight.

FIG. 12 is a block schematic diagram 280 of the synchronized speed control for the motor 232 which drives the lower belt 212 and motors 234 and 235 which control upper belts 228 and 230. The operator controls an "ON" button 282 and an "OFF" button 284. Note that all of the components in FIG. 12 are commercially available and the part numbers are identified. "A/B" indicates an Allen-Bradley part. Three-phase power lines L1, L2, L3 bring power to a remote starter 286 which converts the 3-phase power to DC. An inverter changes the frequency of the power to the individual motors via individual remote starters 232, 234 and 236. The operator sets the speed of the motors/belts by adjusting potentiometer. With this system all of the belts travel at the same speed.

Although the present invention has been shown and described with respect to preferred embodiments, various changes and modifications are deemed to lie within the spirit and scope of the invention as claimed. The corresponding structures, materials, acts, and equivalents of all means or step plus function elements in the claims which follow are intended to include any structure, material, or acts for performing the functions in combination with other claimed elements as specifically claimed.

What is claimed is:

1. A method of processing whole head vegetables characterized by a core end, and an open leafy end, comprising the steps of:

washing the whole head vegetables;

loading the washed whole head vegetables into a plurality of individual totes;

stacking the plurality of individual totes loaded with the whole head vegetables within an enclosure; and

rotating the enclosure about a rotational axis passing through the stacked totes so that moisture is centrifugally forced out of the whole head vegetables.

2. A method as in claim 1 including the step of arranging the whole head vegetables in two rows within each tote and generally abutting the core ends with the open ends oriented away from the axis of rotation.

3. An apparatus for processing harvested vegetables including whole head vegetables characterized by a core end, and an open leafy end, comprising the steps of:

a washer for washing the whole head vegetables;

a plurality of totes for transporting washed whole head vegetables;

a dryer having an enclosure for holding a stack totes filled with washed vegetables;

means for rotating the enclosure about a rotational axis passing through the stacked totes so that moisture is centrifugally forced out of the whole head vegetables, and

wherein the whole head vegetables are arranged in two rows within each tote of the stacked totes, with the core end of each of the vegetables generally abutting and with the open ends oriented away from the axis of rotation.

4. A method for processing harvested produce characterized by a core end, and an open leafy end, comprising:

passing whole head vegetables through a washer which has a bottom belt which passes through a first and a second tanks of cleaning water;

further cleaning the whole head vegetables by spraying the vegetables with water from jets mounted on a plurality of spray bars when the produce is between the first and second cleaning tanks; and

securing the produce as it passes through the first and second cleaning tanks between the top belts and bottom belt at each of the cleaning tanks.

5. The method of claim 4 including the step of controlling the speed of the lower belt, and the upper belts, by a single speed control system.

6. The method of claim 4 including the additional step of choosing the angle of the lower belt conveying the produce through the cleaning tanks for optimum performance.

7. An apparatus for processing harvested vegetables including whole head vegetables, characterized by a core end, and an open leafy end, comprising:

a lower belt for conveying harvested vegetables through at least first and a second tanks of cleaning water;

a plurality of spray bars to further clean the harvested vegetables by spraying the vegetables with water from jets mounted thereon, when the vegetables pass between the first and second cleaning tanks; and

top belts at each of the cleaning tanks above the bottom belt to secure the vegetables on the lower conveyer belt as they pass through the first cleaning tank and through the second cleaning tank.

8. The apparatus of claim 7 including means for controlling the speed of the lower belt, and the top belts, by a single speed control system.

9. The apparatus of claim 7 wherein the lower belt enters the first cleaning tank at an angle of between about −20 degrees to about −27 degrees relative to horizontal.

10. The apparatus of claim 7 wherein the lower belt exits the first cleaning tank and enters the second cleaning tank at an angle of about −20 degrees to about −25 degrees relative to horizontal.

11. The apparatus of claim 7 wherein the lower belt exits the second tank at an angle of about −20 degrees to about −27 degrees relative to horizontal.

12. The apparatus of claim 7 wherein each of the cleaning tanks is provided with at least one clean out port.

13. The apparatus of claim 12 wherein the at least one cleanout port is provided with a door latch mechanism.

14. The apparatus of claim 7 including a centrifugal dryer for drying the washed vegetables.

15. The apparatus of claim 7 wherein the centrifugal dryer dries vegetables which are stored in totes comprising:

an outer dryer body having a top and bottom, an outer body opening, a door for enclosing the outer body opening during the operation of the dryer, and top and bottom spindle supports located in the top and bottom of the dryer body;

an inner frame having an opening which can be aligned with the outer body opening so that a plurality of totes can be placed and stacked within the inner frame;

spindle shafts attached at the top and bottom of the inner frame which define an axis of rotation and which are rotatably supported by the top and bottom spindle supports, respectively;

a motor for rotating the inner frame about the rotational axis during operation of the dryer; and

a door for closing the opening in the inner frame after the totes have been stacked within the frame.

16. A centrifugal dryer as in claim 15 wherein the totes are rectangular in shape and the inner frame is also rectangular and and a stack of totes which conforms to the shape of the inner frame.

17. A centrifugal dryer as in claim 15 wherein the vegetables are whole head vegetables having cut ends and leafy ends which are placed within the totes in rows wherein the cut ends are generally adjacent to each other and the leafy ends extend outwardly in a direction generally away from the axis of rotation.

* * * * *

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Herrera (43) Pub. Date: Nov. 27, 2003

(54) APPARATUS AND METHOD FOR HARVESTING AND CORING PRODUCE

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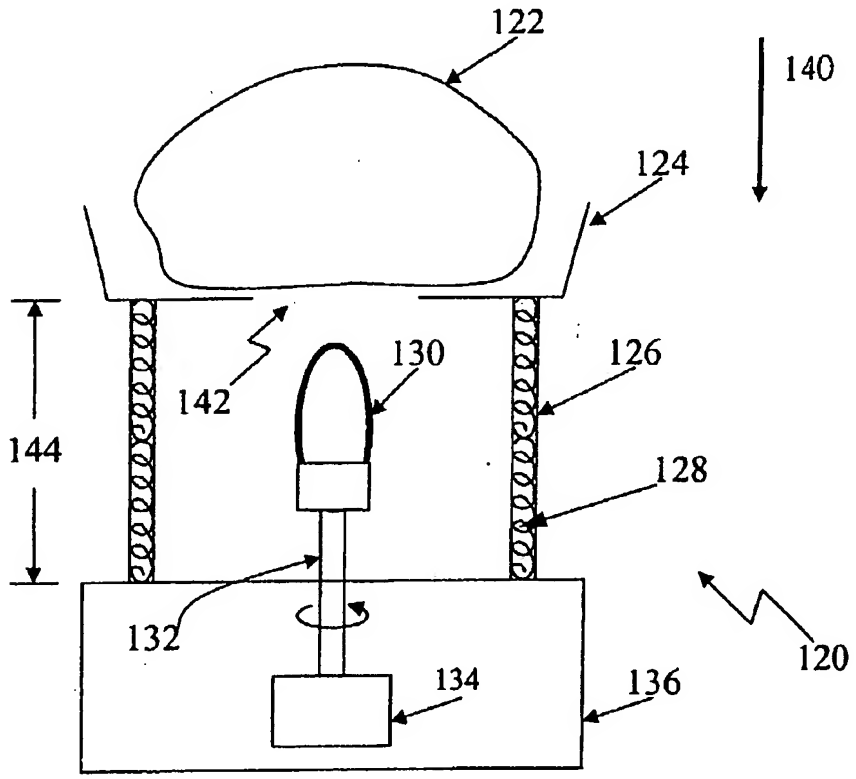
(52) U.S. Cl. 99/547; 56/122

(57) ABSTRACT

The present invention provides an apparatus and method for harvesting and processing produce including a produce seat having a cutter aperture, wherein the produce seat receives produce such that the produce is aligned with a cutter. The cutter is secured with a shaft that is rotationally coupled with a motor configured to rotate the shaft and cutter. A support is configured to position the produce seat proximate the cutter and the support is configured to allow the produce seat to be moved from a first position where the produce seat is proximate the cutter, to a second position such that at least a portion of the cutter extends through the cutter aperture, and to allow the produce seat to be returned to the first position.



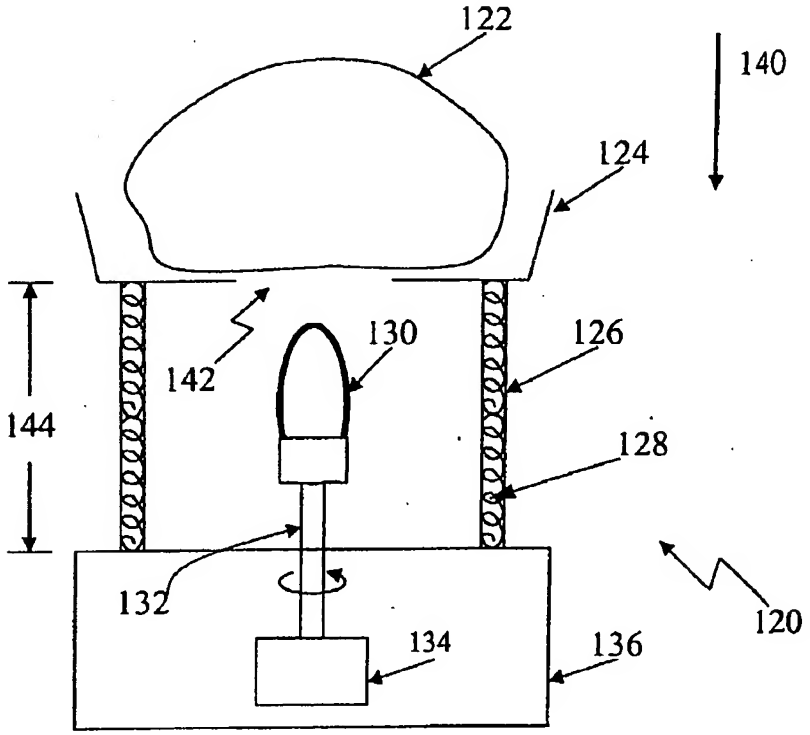
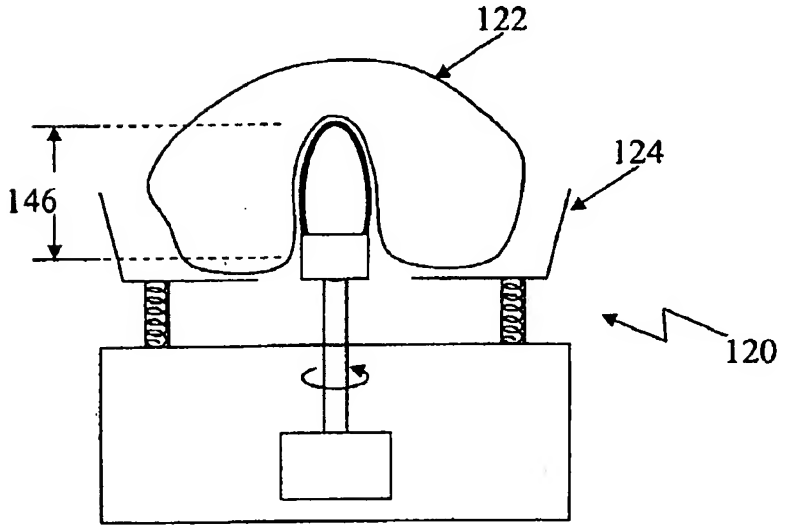


FIG. 1

FIG. 2



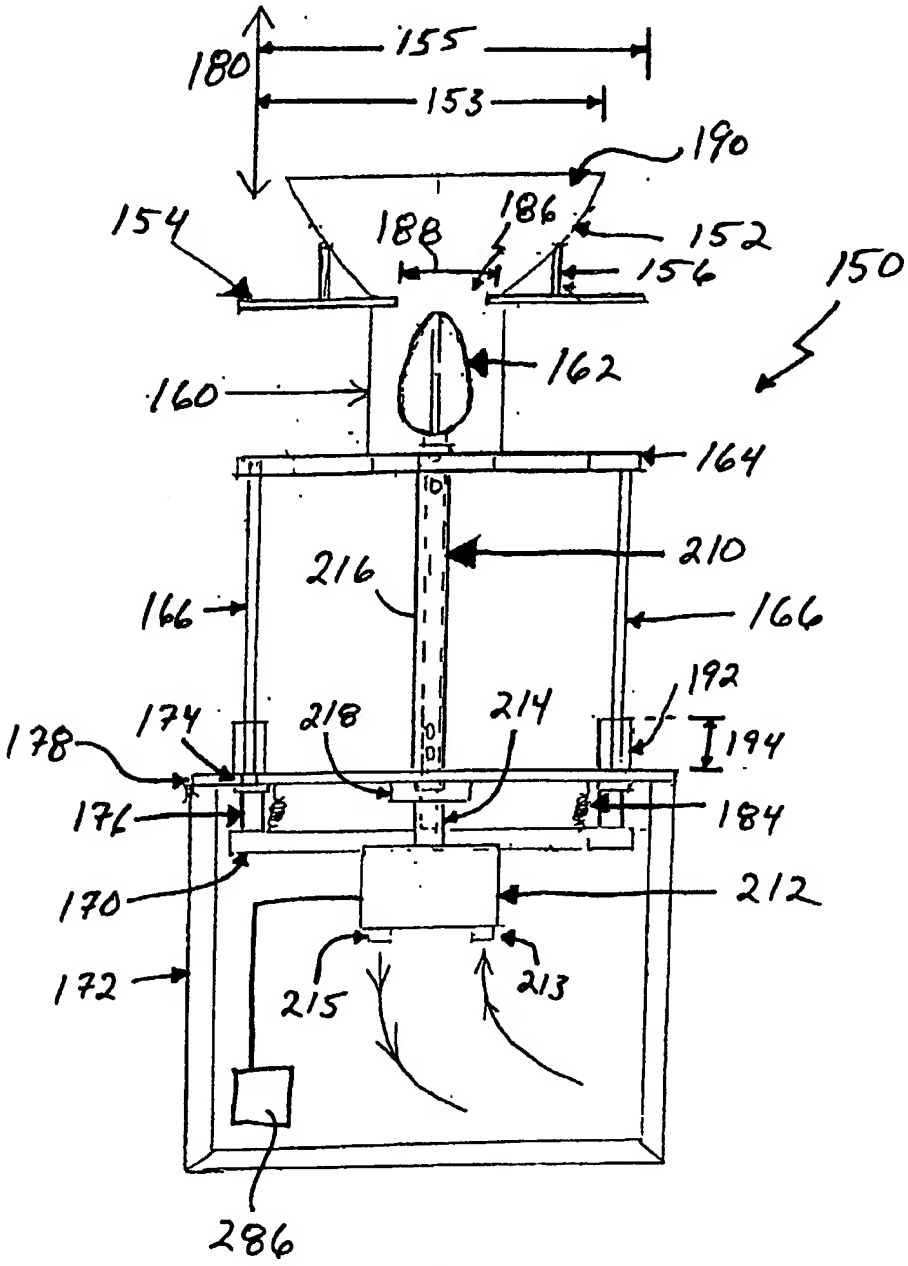

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FIG. 3

FIG. 4

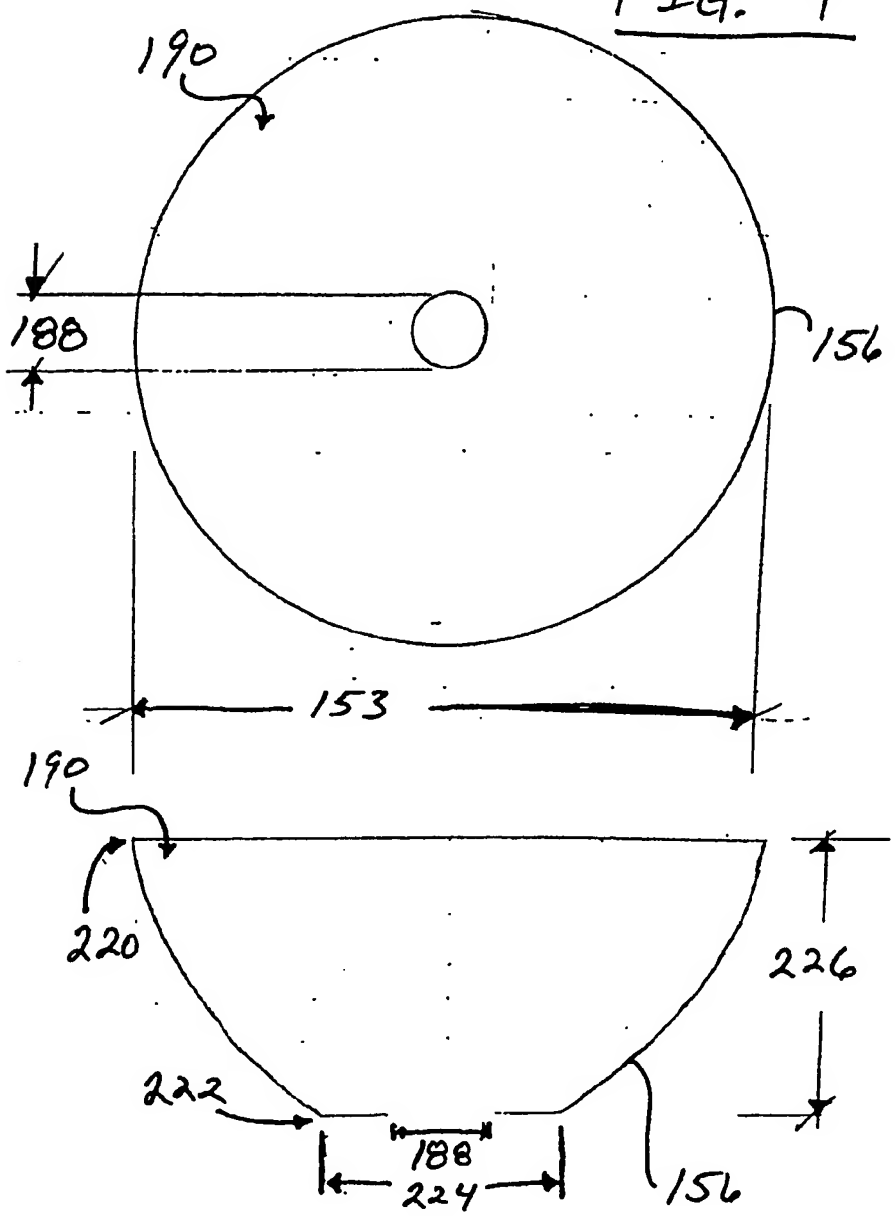


FIG. 5

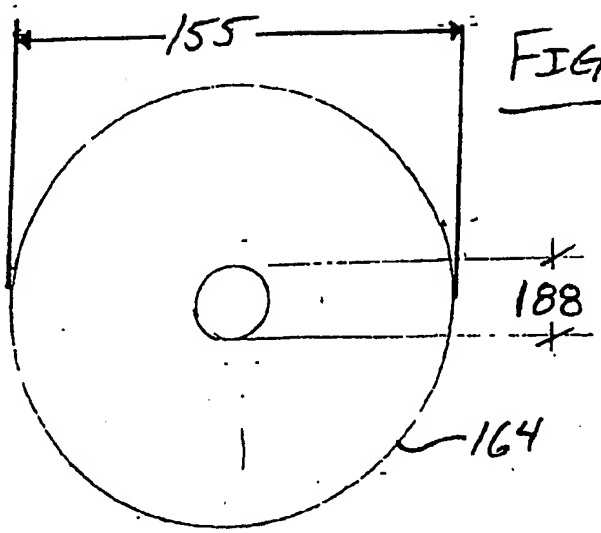


FIG. 6

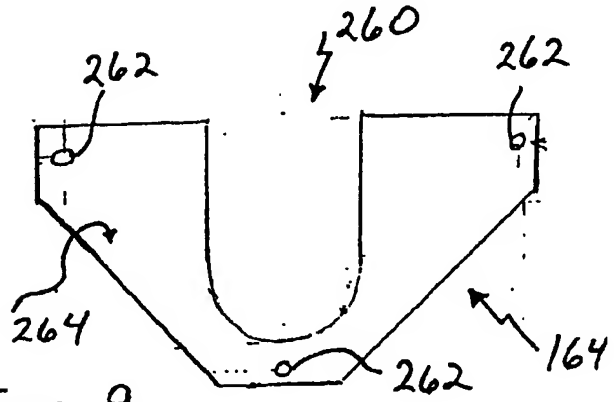


FIG. 9

FIG. 10

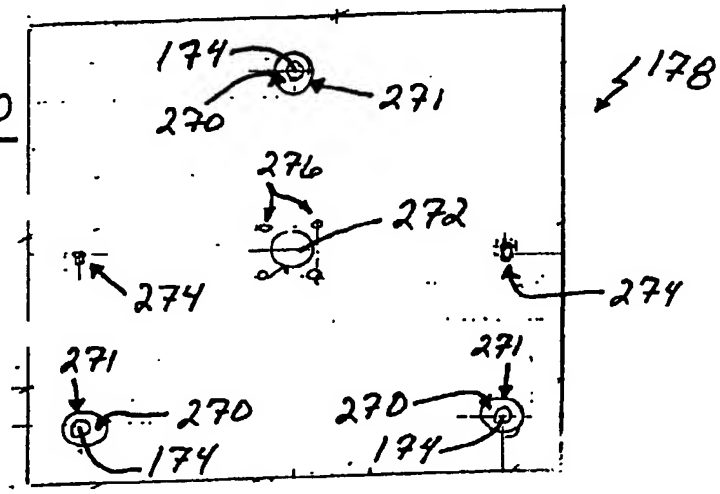


FIG. 7

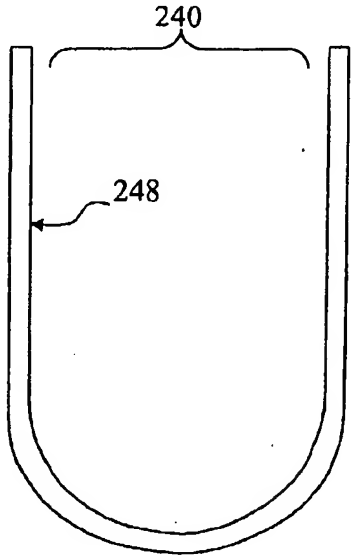
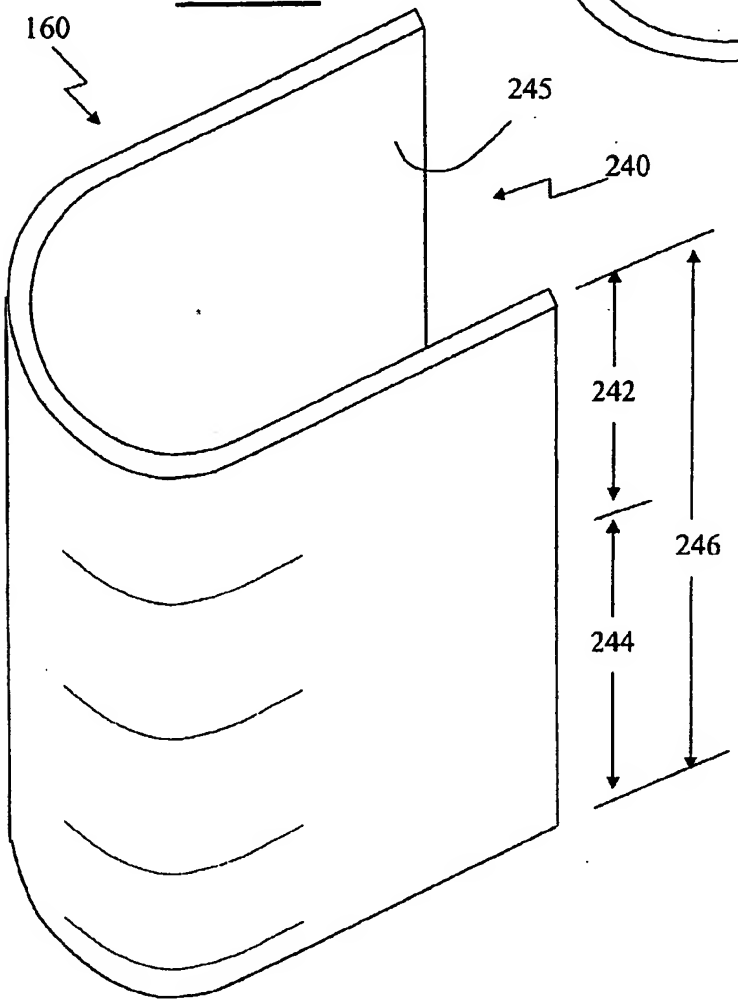


FIG. 8



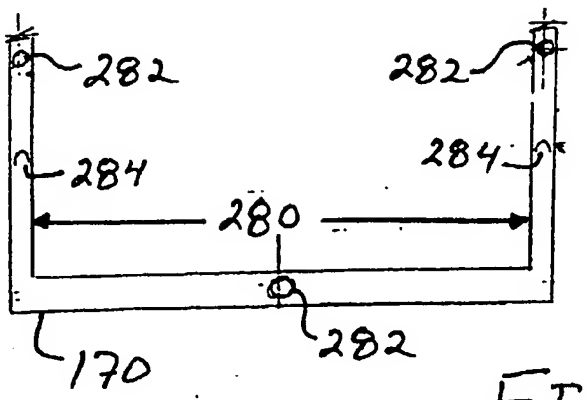


FIG. 11

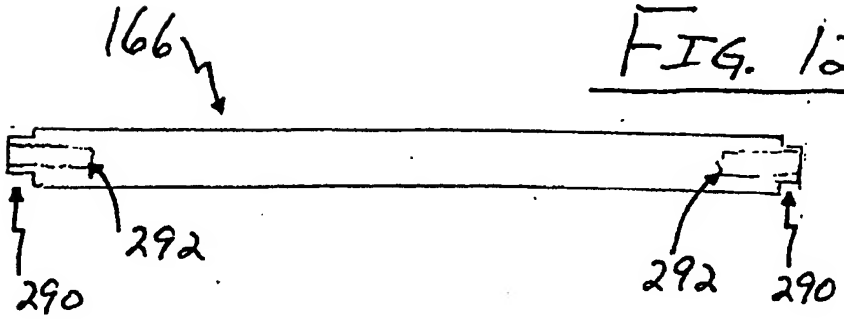


FIG. 12

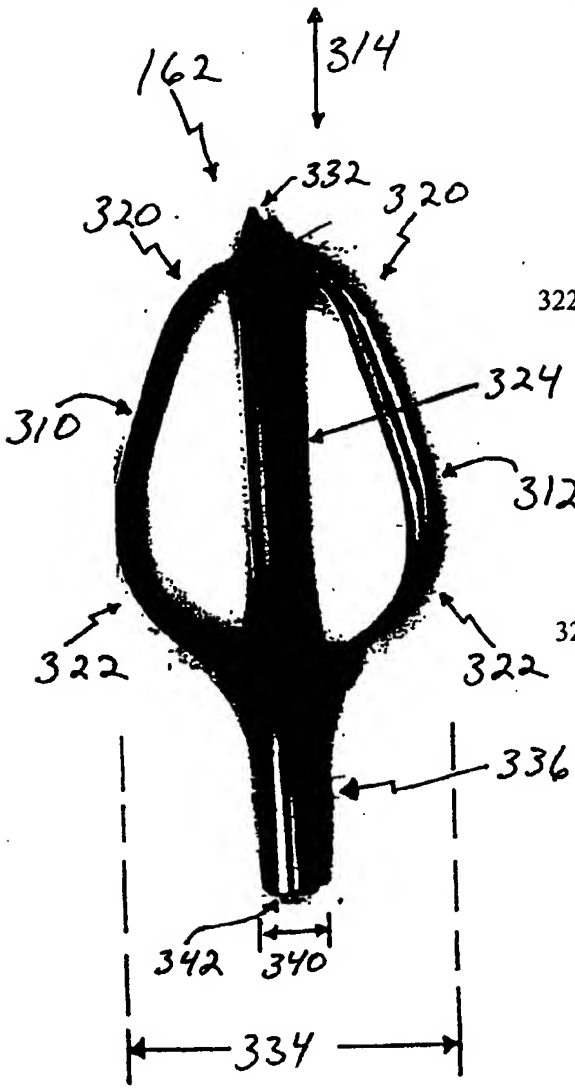


FIG. 13

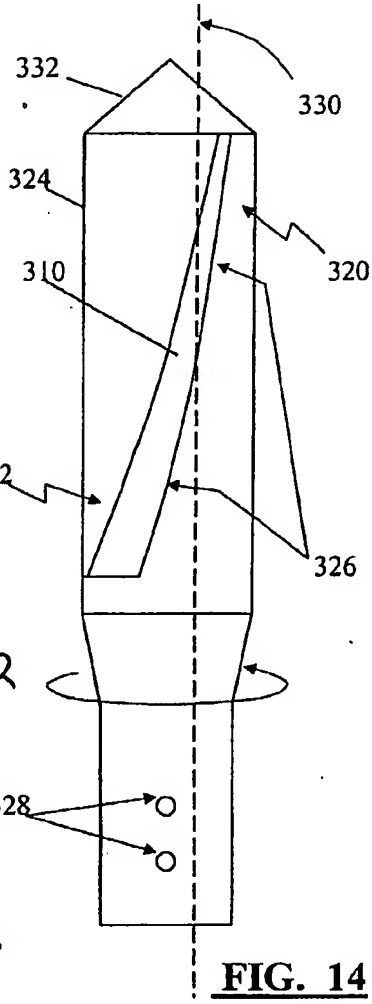


FIG. 14

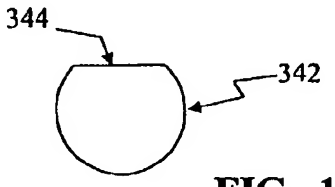


FIG. 15

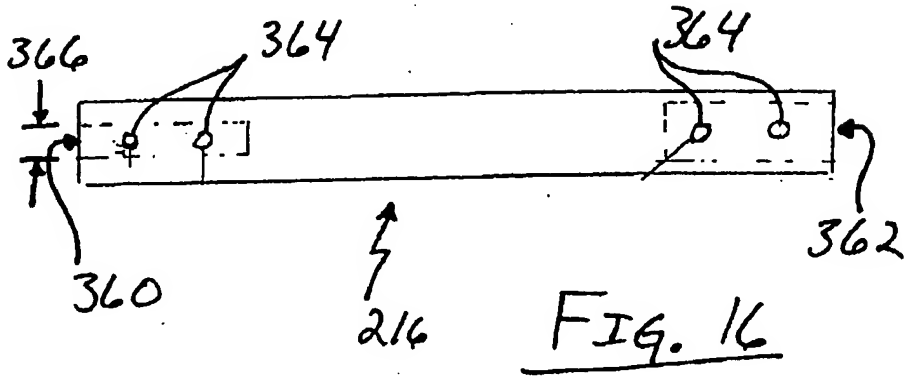


FIG. 16

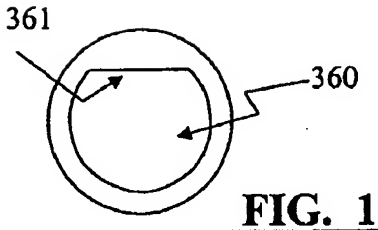


FIG. 17

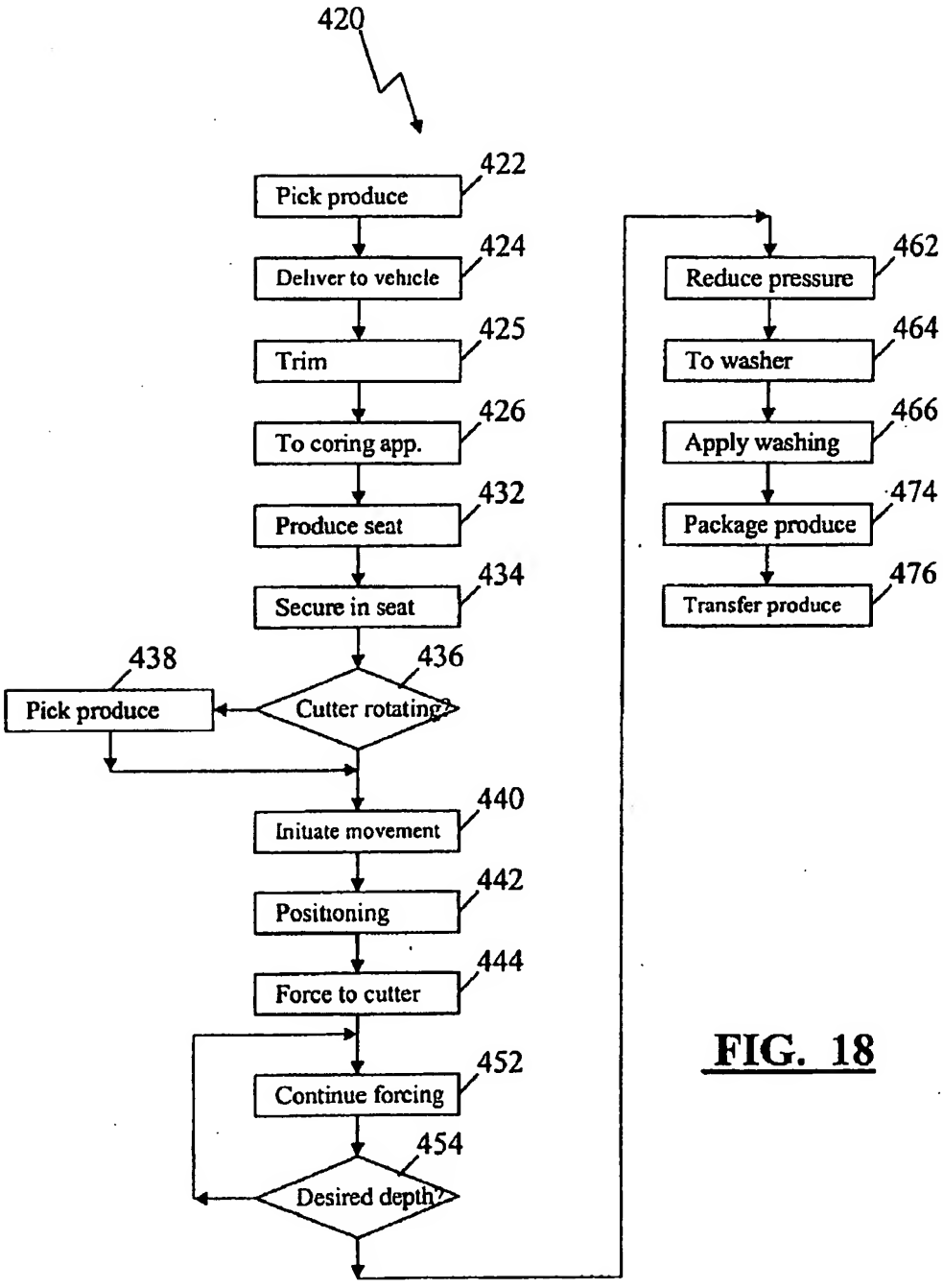
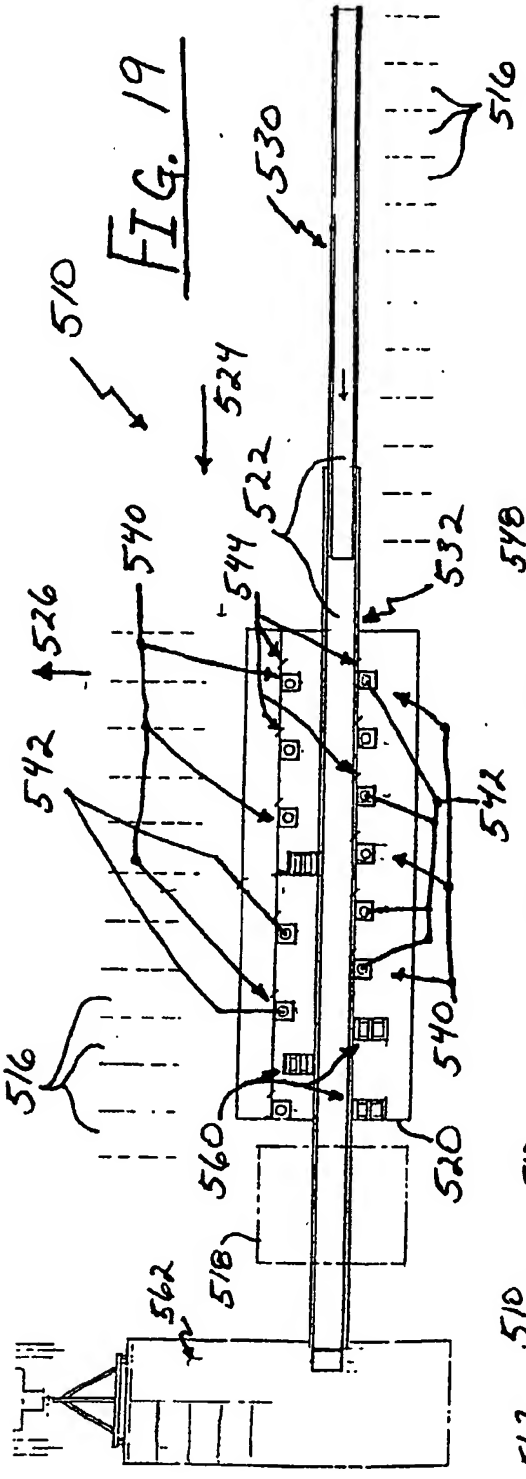

420
422
Pick produce
424
Deliver to vehicle
425
Trim
426
To coring app.
432
Produce seat
434
Secure in seat
436
Cutter rotating?
438
Pick produce
440
Initiate movement
442
Positioning
444
Force to cutter
452
Continue forcing
454
Desired depth?
462
Reduce pressure
464
To washer
466
Apply washing
474
Package produce
476
Transfer produce

FIG. 18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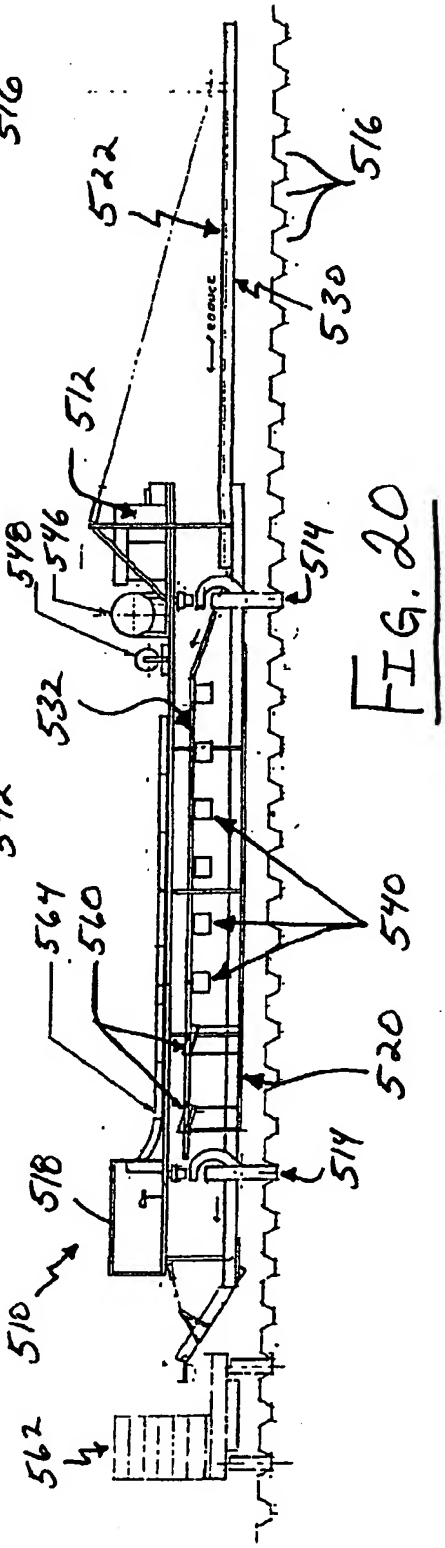
524
530
516
522
532
540
544
526
542
542
516
560
520
562
518

FIG. 19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516
530
512
548
546
514
532
564
560
540
520
514
518
510
562

FIG. 20

FIG. 21

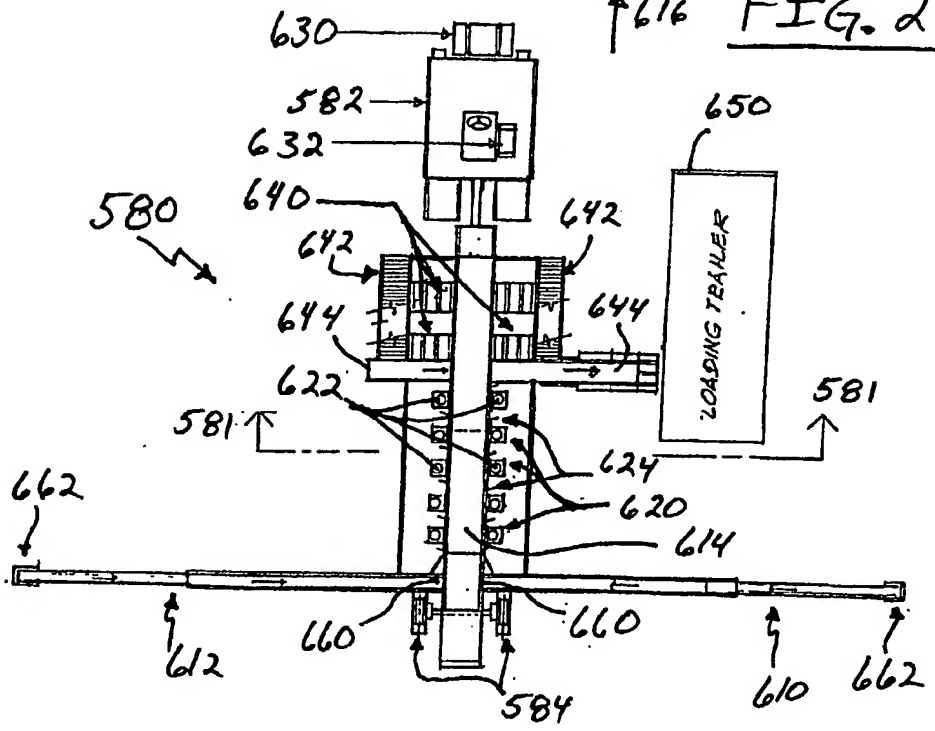
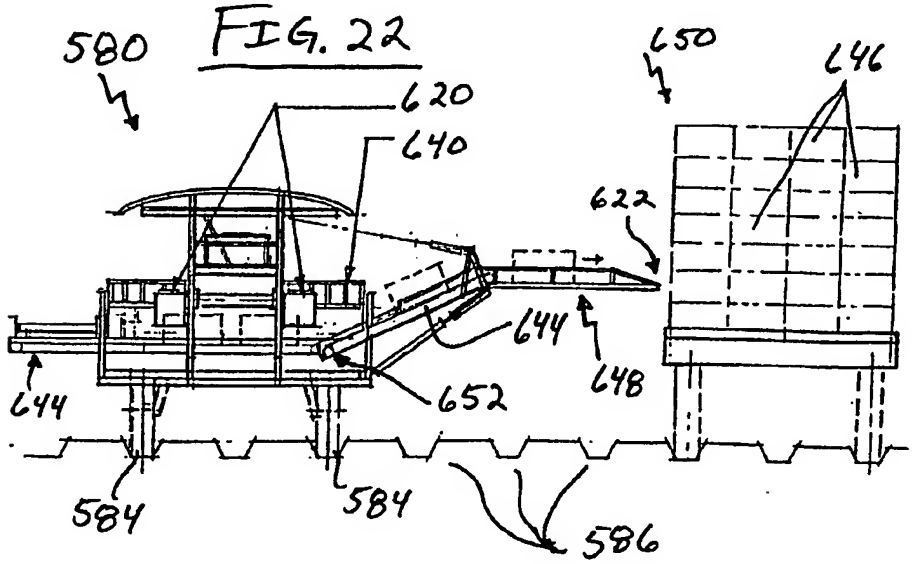

616
630
582
632
650
580
640
642
642
644
644
622
LOADING TRAILER
581
581
624
620
614
662
660
660
612
610
662
584

FIG. 22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620
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650
646
622
644
644
652
648
584
584
586

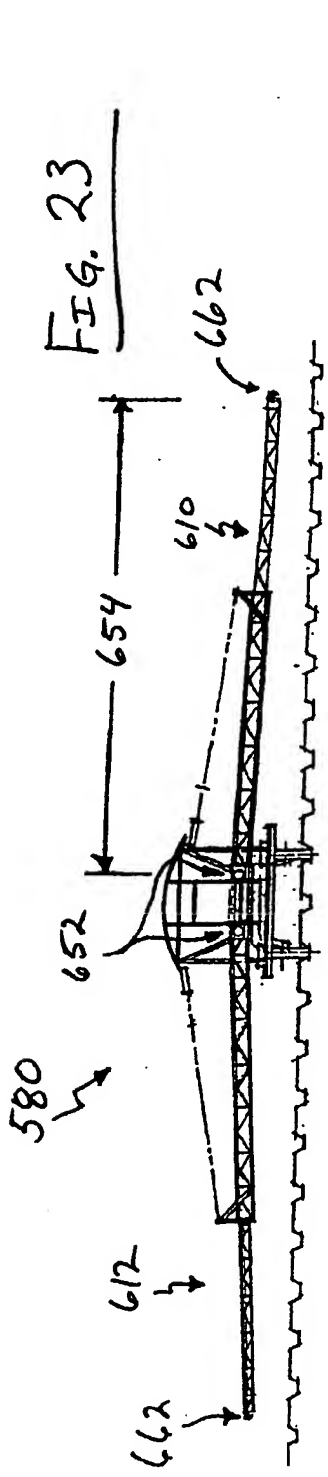
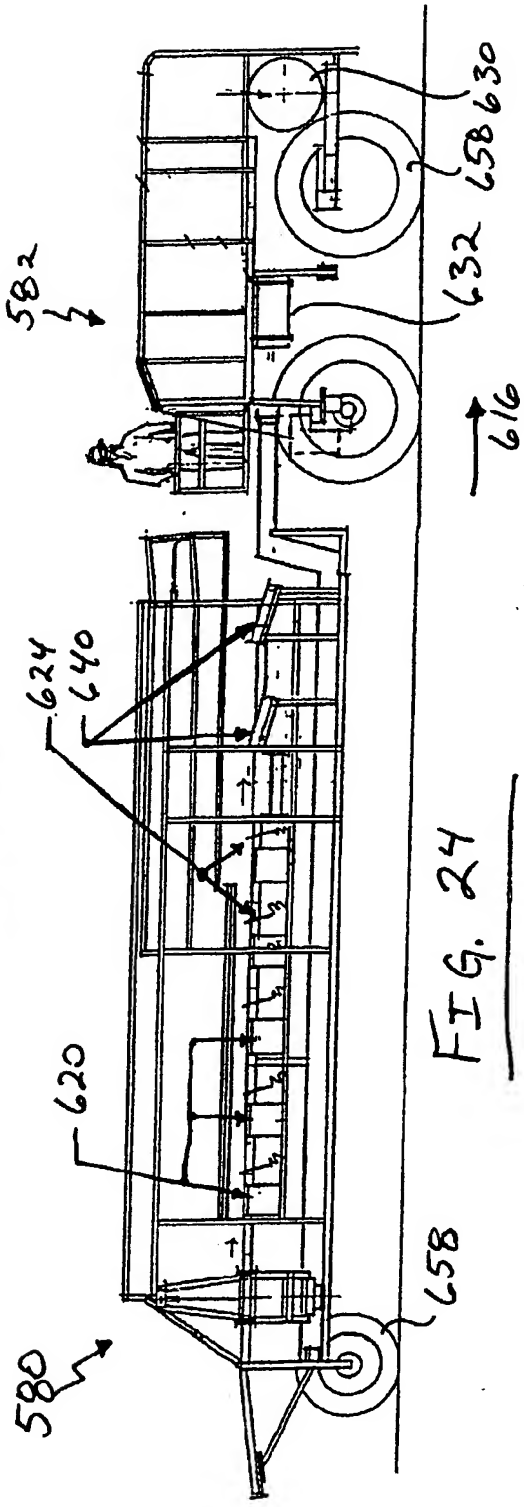

662
610
654
652
580
612
642

FIG. 23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630
658
632
616
624
640
620
658
580

FIG. 24

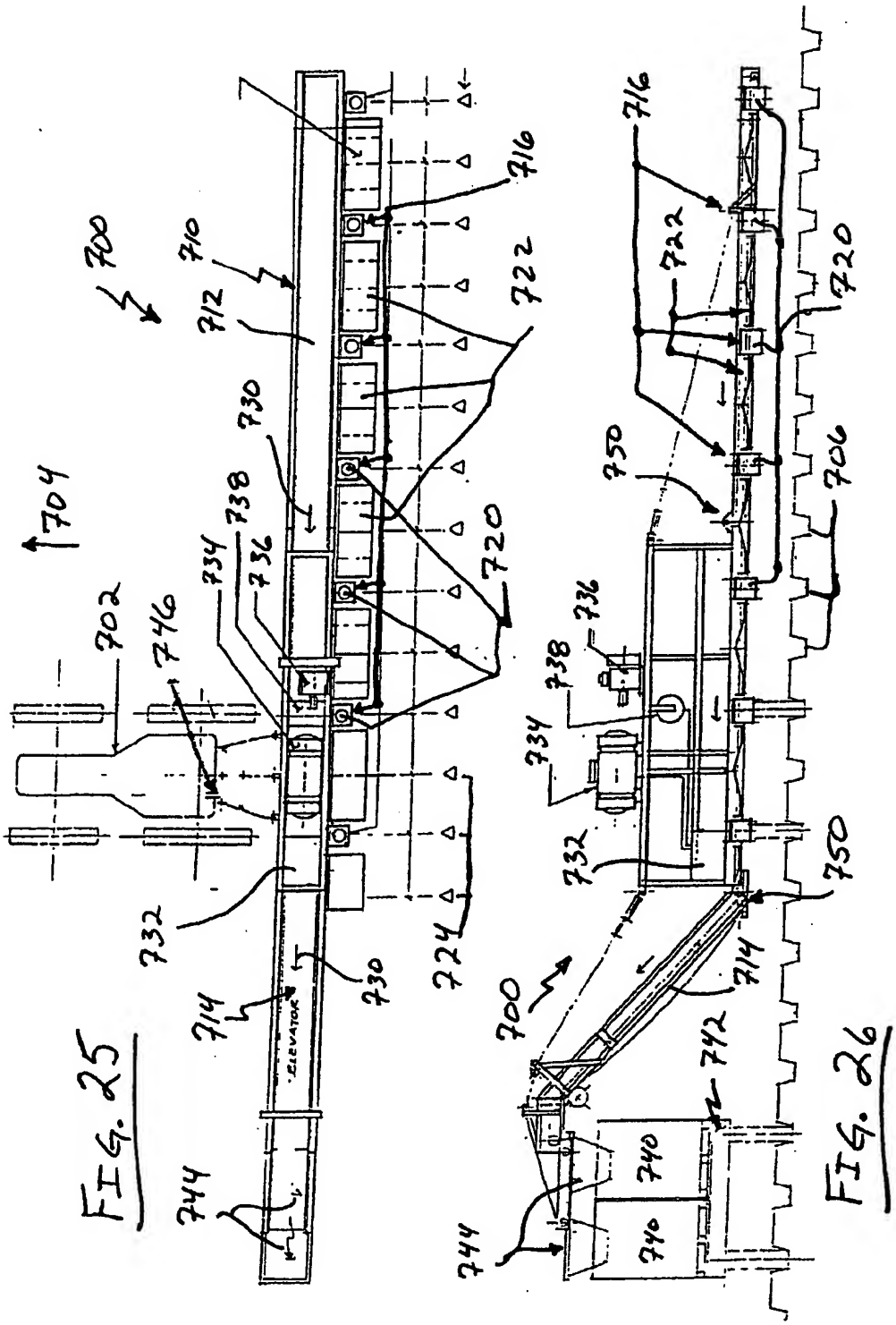

700
710
712
716
722
730
738
734
736
720
704
702
746
732
714
730
724
744
ELEVATOR
716
722
720
750
706
736
738
734
732
750
714
700
742
740
740
744

FIG. 25

FIG. 26

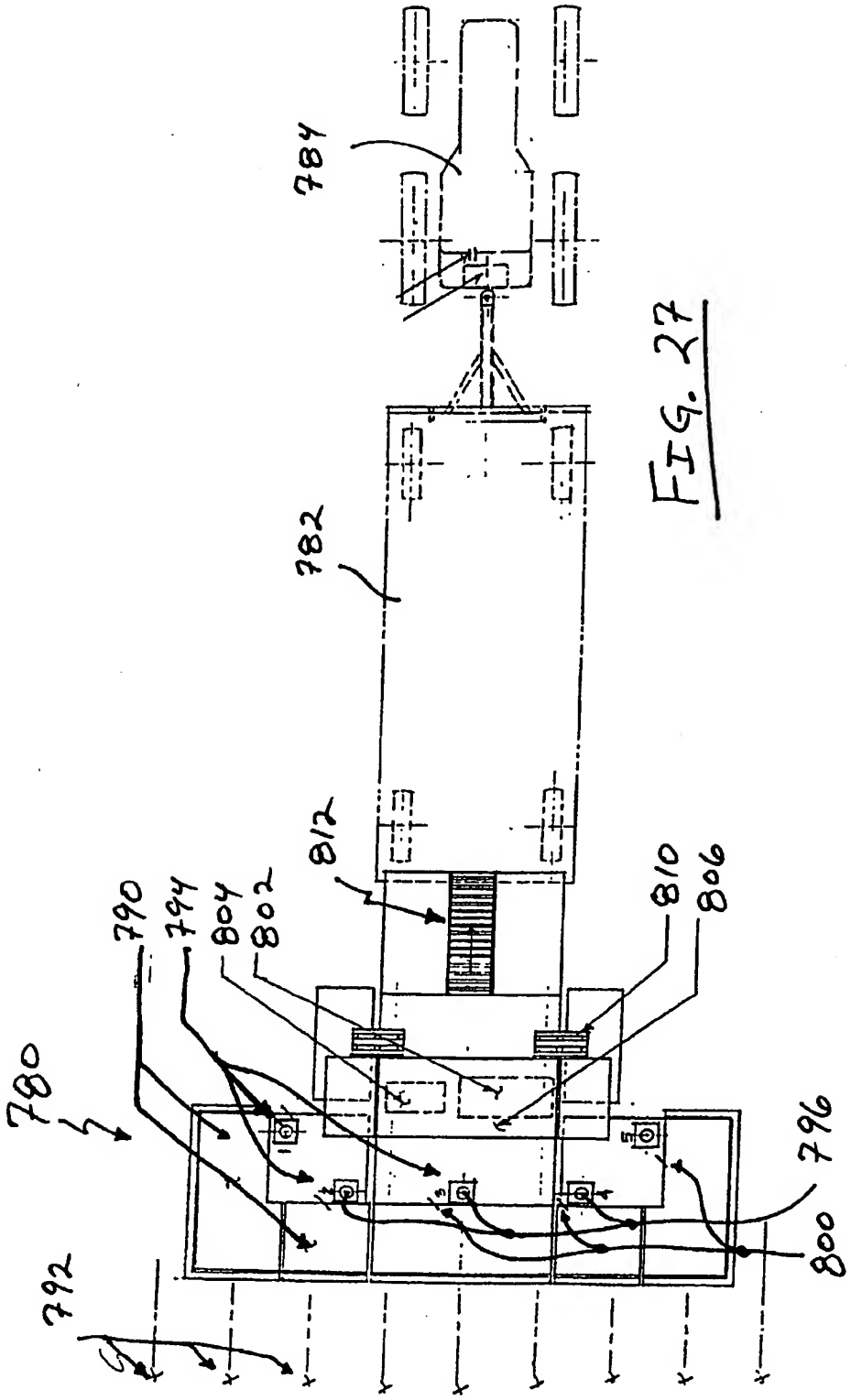


FIG. 27

FIG. 28

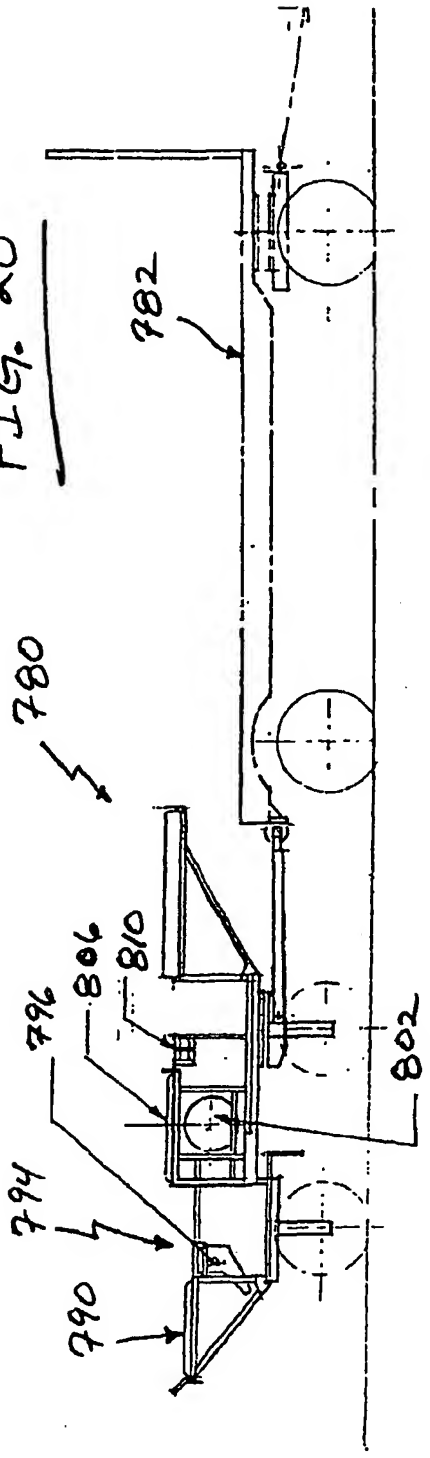
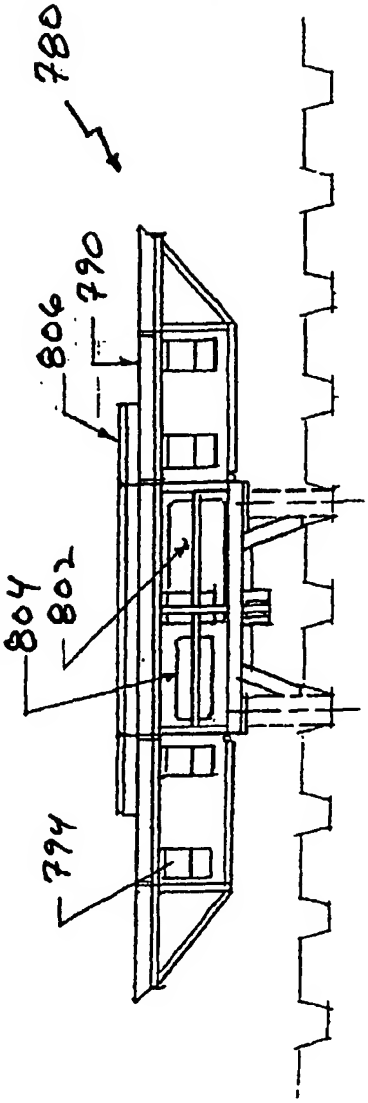


FIG. 29



APPARATUS AND METHOD FOR HARVESTING AND CORING PRODUCE

BACKGROUND OF THE INVENTION

[0001] 1. Field of the Invention

[0002] The present invention relates generally to produce harvesting, and more specifically to harvesting and preparing produce for shipment.

[0003] 2. Discussion of the Related Art

[0004] Produce is often damaged during harvesting and during preparation for shipment. For example, some produce such as cauliflower, lettuce, cabbage, and other such produce are cored following harvesting in preparation for shipment. Many previous coring devices require an individual to manually core the produce. One example of a previous coring device is a coring ring. In use, a coring ring is forced into the produce, generally hammered into the produce in order to achieve a desired penetration. This often causes damage and is not accurate. Typically, the produce is set onto a hard surface while the coring ring is slammed into the produce. The hard surface most often causes bruising and damage to the produce.

SUMMARY OF THE INVENTION

[0005] The present invention advantageously addresses the needs above as well as other needs by providing an apparatus and method for harvesting and processing produce. In one embodiment, the invention can be characterized as an apparatus for coring produce having a produce seat having a cutter aperture, wherein the produce seat is configured to receive produce to be cored such that the portion of the produce to be cored is positioned and aligned with the cutter aperture; a cutter is secured with a shaft, the shaft being rotationally coupled with a motor configured to cause the shaft and cutter to rotate, wherein the cutter is aligned with the cutter aperture; and a support being configured to position the produce seat such that the produce seat is positioned proximate the cutter and the cutter aperture is aligned with the cutter, wherein the support is configured to allow the produce seat to be moved from a first position where the produce seat is proximate the cutter, to a second position such that at least a portion of the cutter extends through the cutter aperture, and to allow the produce seat to be returned to the first position.

[0006] In another embodiment, the invention can be characterized as an apparatus for processing harvested produce having a motor rotationally coupled with a shaft at a first end of the shaft; a cutter being secured to a second end of the shaft such that the cutter rotates as the shaft rotates; a produce seat having a cutter aperture, wherein the produce seat is movable along an axis such that in a first position the produce seat is proximate the cutter and the cutter does not extend through the cutter aperture, and in a second position the cutter at least partially extends through the cutter aperture.

[0007] In another embodiment, the invention can be characterized as a harvesting vehicle for harvesting produce, where the vehicle includes a frame supported by one or more movement devices, wherein the frame provides rigidity and structure to the harvesting vehicle; one or more processing stations having a coring apparatus, wherein the coring apparatus comprises: a produce seat having a cutter aperture, where in the produce seat is configured to receive produce such that a portion of the produce to be cored is aligned with the cutting aperture; a cutter aligned with the cutter aperture; and one or more supports configured to provide positioning of the produce seat, such that in a first position the cutter does not extend through the cutter aperture and in a second position the cutter extends at least partially through the cutter aperture.

[0008] In another embodiment, the invention can be characterized as a method for coring produce. The method for coring produce comprising the steps of positioning the produce in a produce seat; aligning the produce with a cutter aperture of the produce seat; forcing the produce seat and produce towards the cutter; causing the cutter to contact the produce; continuing to force the produce onto the cutter until a desired penetration of the cutter into the produce is achieved providing a cored produce; forcing the cored produce away from the cutter; and removing the cored produce from the produce seat.

[0009] In another embodiment, the invention can be characterized as an n apparatus for processing harvested produce. The apparatus includes means for receiving and maintaining produce, the means for receiving and maintaining the produce including an aperture; means for cutting aligned with the aperture; means for rotating being secured with the means for cutting, such that the means for rotating rotates the means for cutting; means for supporting the means for receiving and maintaining the produce, wherein the means for supporting allow movement of the means for receiving and maintaining such that in a first position the means for cutting is not protruding through the aperture, and in a second position the means for cutting at least partially extends through the aperture; and means for resisting movement of the means for receiving and maintaining from the first position to the second position.

[0010] A better understanding of the features and advantages of the present invention will be obtained by reference to the following detailed description of the invention and accompanying drawings that set forth an illustrative embodiment in which the principles of the invention are utilized.

BRIEF DESCRIPTION OF THE DRAWINGS

[0011] The above and other aspects, features and advantages of the present invention will be more apparent from the following more particular description thereof, presented in conjunction with the following drawings wherein:

[0012] **FIG. 1** depicts a cross-sectional view of a simplified block diagram of an apparatus for coring produce in a first position;

[0013] **FIG. 2** depicts a cross-sectional view of the apparatus shown in **FIG. 1** in a second position;

[0014] **FIG. 3** depicts a cross-sectional view of an apparatus according to one embodiment of the present invention for coring produce;

[0015] **FIG. 4** shows a simplified block diagram of an elevated view of a produce seat according to one embodiment of the present invention;

[0016] **FIG. 5** depicts a cross-sectional view of the produce seat shown in **FIG. 4**;

[0017] **FIG. 6** depicts a simplified elevated view of one embodiment of a press plate;

[0018] **FIG. 7** shows an elevated view of one embodiment of a cutter guard;

[0019] **FIG. 8** shows an elevated side view the cutter guard shown in **FIG. 7**;

[0020] **FIG. 9** shows an elevated view of a support plate according to one embodiment of the present invention;

[0021] **FIG. 10** depicts a simplified elevated view of a housing lid according to one embodiment;

[0022] **FIG. 11** depicts a simplified elevated view of one embodiment of a base support plate;

[0023] **FIG. 12** shows a simplified cross-sectional view of a support according to one embodiment of the present invention;

[0024] **FIG. 13** depicts an elevated view of one implementation of a cutter according to one embodiment of the present invention;

[0025] **FIG. 14** depicts a simplified block diagram of an elevated perpendicular view of the cutter shown in **FIG. 13**;

[0026] **FIG. 15** shows a cross-sectional view of a base of a mounting post of the cutter shown in **FIGS. 13 and 14**;

[0027] **FIG. 16** depicts a plain view of an extension shaft according to one embodiment of the present invention;

[0028] **FIG. 17** shows one embodiment of a cross-sectional view of the extension shaft;

[0029] **FIG. 18** depicts a simplified flow diagram of a process for harvesting and preparing produce for shipment;

[0030] **FIG. 19** depicts an elevated view of an agricultural harvesting vehicle according to one embodiment of the present invention;

[0031] **FIG. 20** depicts a cross-sectional view of the agricultural harvesting vehicle shown in **FIG. 19**;

[0032] **FIG. 21** depicts an elevated view of a harvesting vehicle **580** according to one embodiment of the present invention;

[0033] **FIGS. 22, 23** and **24** depict a cross-sectional view along an axis, a rear elevated view and a side elevated view, respectively, of the harvesting vehicle shown in **FIG. 21**;

[0034] **FIGS. 25 and 26** depict an elevated view and a cross-sectional view, respectively, of a harvesting vehicle according to one embodiment of the present invention; and

[0035] FIGS. **27-29** show an elevated view, cross-sectional view and a rear view, respectively, of a harvesting apparatus according to one embodiment of the present invention.

[0036] Corresponding reference characters indicate corresponding components throughout the several views of the drawings.

DETAILED DESCRIPTION OF THE INVENTION

[0037] The following description is not to be taken in a limiting sense, but is made merely for the purpose of describing the general principles of the invention. The scope of the invention should be determined with reference to the claims.

[0038] The present invention provides for a method and apparatus for harvesting and preparing produce for shipment. The method and apparatus provide for the removal of a core from harvested produce or products while still in the fields. The removal of the core while still in the fields during harvesting limits how much the produce needs to be handled in processing and preparing the produce for shipment and reduces the amount of damage to the produce. Thus, the present invention delivers a higher quality of produce.

[0039] The present invention provides for additional processing while in the fields to prepare the produce for shipment. In one embodiment, the present apparatus and method provide for cleaning of the produce while still in the fields. The present invention allows for the cleaning prior to or following the coring. The cored and cleaned produce is then packaged and ready for shipment.

[0040] In one embodiment, the present apparatus and method are implemented within a produce processing plant. The produce is cored during processing and packaging. Additionally, the produce is washed and packaged for shipment.

[0041] **FIGS. 1 and 2** depict a cross-sectional view of a simplified block diagram of an apparatus **120** for coring produce according to one embodiment of the present invention. A product or produce **122** is received in a produce seat or mount **124**. The produce seat **124** is supported by one or more supports **126** above a cutting device **130**, such as blade, a plurality of blades or other such devices.

[0042] The cutting device **130** is secured to a shaft **132** at a first end of the shaft. A second end of the shaft **132** is secured to a motor **134**. The motor is configured to rotate the shaft **132** and thus the cutting device **130**. In one embodiment, the motor is secured within a housing **136**. The motor **134** can be substantially any type of motor capable of rotating the shaft **132** and cutting device **130** including electrical, hydraulic, mechanical, pneumatic and substantially any other motor. The produce seat **124** includes an aperture **142**. The aperture **142** has a width or diameter greater than the width or diameter of the rotation of the cutting device **130**.

[0043] **FIG. 1** shows the apparatus **120** with the produce seat **124** in a first position such that the produce **122** is not in contact with the cutting device **130**. **FIG. 2** shows the apparatus with the produce seat **124** in a second position with the cutting device extending through the aperture **142** penetrating into the produce **122**. In operation, the produce **122** is initially positioned in the produce seat **124**. While the motor **134** is active and rotating the cutting device **130**, the produce **122** and produce seat **124** are moved towards the cutting device along the axis **140**. The produce **122** is forced onto the rotating cutting device such that the cutting device pierces the produce **122** and begins to cut out a portion of the produce. The produce and produce seat are forced along an axis **140** until the cutting device **130** has penetrated into the produce to a desired depth or the produce seat **124** and produce **122** cannot be forces further along the axis **140**. The produce **122** and produce seat **124** are then returned to the first position such that the produce **122** is not in contact with

the cutting device **130**. In one embodiment, the apparatus **120** further includes one or more compression resistance devices **128** configured to resist movement of the produce seat **122** in the direction towards the cutting device **130**, along an axis **140**. Upon release of pressure, the compression resistance devices **128** begin to force the produce seat back to the first position. Thus, the cutting device has cut out a portion of the produce, preferably the core of the produce.

[0044] The cutting device **130** can be of any size such that the rotational width or diameter of the cutting device is sufficiently large to remove the desired amount of the produce to remove the core. Further, the height or distance **144** along the axis **140** that the produce seat **124** and the produce **122** can be moved can be of substantially any length so that the cutting device **130** penetrates into the produce **122** to a desired depth **146** within the produce **122** (see **FIG. 2**).

[0045] **FIG. 3** depicts a cross-sectional view of an apparatus **150** according to one embodiment of the present invention for coring produce. The apparatus **150** includes a produce seat **152** that receives produce to be cored. In one embodiment, the produce seat **152** is concaved to aid in maintaining the position of the produce within the seat **152** during coring. The produce seat **152** is mounted on a press plate **154**. In one embodiment, one or more seat supports **156** are secured between the produce seat **152** and the press plate **154** to provide increased rigidity and stability.

[0046] The press plate typically is configured to have a width or diameter **155** that exceeds a width or diameter **153** of the produce seat **152**. This allows an operator of the apparatus **150** to easily access and apply pressure on the press plate **154** to push or force the press plate and produce seat, and thus the produce within the produce seat, towards a cutter **162**.

[0047] The press plate is secured to a cutter guard **160**. The cutter guard provides support and positioning for the produce seat **152**. In one embodiment, the cutter guard **160** at least partially surrounds or covers the cutter **162**. The cutter can be one or more blades or other structures capable of cutting a selected produce. The cutter guard **160** provides safety to protect operators of the apparatus **150** from the cutter **162** and protects the cutter from damage. In one embodiment, the cutter guard is simply one or more beams or rods distributed about the cutter to support the produce seat **152**. The cutter guard is further secured to a support plate **164**. One or more supports **166** are secured between the support plate and a base support plate **170**. In one embodiment, the cutter guard is formed by the supports. In this embodiment, the support plate is not utilized and the supports extend between the base support plate **170** and the produce seat **152** and/or press plate **154**.

[0048] The base support plate **170** is positioned within a housing **172**. The supports **166** pass through one or more support apertures **174** of a lid **178** of the housing **172**. The supports are additionally axially aligned with and pass through linear motion flanges **176**. In embodiment, the support apertures **174** and motion flanges **176** are such that the supports **166** freely move through the support apertures and motion flanges along a first axis **180** of the supports. The linear motion flanges **176** aid in maintaining the stability of the supports **166** and maintaining the linear direction of motion of the supports along the first axis **180**. The support apertures **174**, motion flanges **176**, the base support plate **170** and the support plate **164** maintain the position of the produce seat **152** relative to the cutter **162** to stabilize and maintain the positioning of the produce during coring. In one embodiment, the supports and support plate and/or the base support plate are a single continuous piece. One or more expansion resistance devices and/or compression resistant devices **184** are included to resist the movement of the support plate **164**, and thus the produce seat **152** and produce, along the first axis **180** towards the housing **172**. In one embodiment, expansion resistance devices **184** are secured between the lid **178** of the housing and the base support plate **170**. As the produce seat **152** is forced towards the housing **172** the base support plate **170** is forced away from the lid **178** expanding the expansion resistance devices **184**.

[0049] Upon reduction or release of the force pushing the produce seat towards the housing, the expansion resistance devices **184** forces the base support plate **170** back towards the lid **178**, and thus forcing the produce seat **152** away from the housing **172**. The expansion (or/and compression) resistance devices **184** can be substantially any expansion and/or compression resistance device including springs, hydraulics and substantially any other expansion or/and compression resistant device. In one embodiment, the extension resistance devices can be configured to limit the rate at which the produce seat and produce return to a first starting position where the cutting device is not penetrating the cutter aperture **186**. Alternatively, the apparatus **150** includes dampeners that reduce or limit the rate at which the produce seat returns to the first position.

[0050] The cutter **162** is secured to a shaft **210**. The shaft extends away from the cutter **162** and produce seat **152** extends through the support plate **164** and the lid **178**, and is secured with a motor **212**. The motor is configured to rotate the shaft **210** causing the cutter to rotate. The motor can be substantially any type of motor. In one embodiment, the motor is a hydraulic motor and includes a hydraulic fluid input port **213** and output port **215**. The rotational speed of the shaft **210** and cutter **162** can be a single speed or be controlled by substantially any control including, manual, feedback through a processor and other such controls.

[0051] In one embodiment, the shaft **210** includes a motor shaft **214** and a shaft extension **216**. The motor shaft **214** is secured with the motor **212** and is rotated by the motor. The extension shaft **216** is secured with the motor shaft and extends through the lid **178** and support plate **164** to be attached with and rotate the cutter **162**.

[0052] In one embodiment, the apparatus **150** includes a shaft bearing and/or seal **218**. The shaft bearing/seal is secured to the lid **178** and includes an aperture (not shown) to allow the shaft **210** to extend through the shaft bearing/seal. The aperture of shaft bearing/seal **218** is configured to have a diameter or width that is just larger than the diameter or width of the shaft such that the bearing is in contact with the shaft. The bear rotates as the shaft rotates. The bearing/seal **218** aids in preventing debris, such as dust, dirt, produce cuttings and other debris, from entering the housing **172** and provides added stability to the shaft **210**.

[0053] The produce seat **152** and press plate **154** include corresponding and aligned cutter apertures **186**. The cutter aperture is typically configured to have a width or diameter

188 greater than a width or rotational diameter 334 (see FIG. 13) of the cutter 162. As such, when a force is applied to the press plate 154 and/or produce seat 152 towards the cutter, the produce seat moves along the first axis 180 so that at least a portion of the cutter 152 extends up into a cavity 190 of the produce seat.

[0054] In one embodiment, the apparatus 150 includes one or more stops 192. The stops are positioned to halt the movement of the produce seat 152 and press plate 154 along the first axis 180 towards the housing 172. This prevents further penetration of the cutter 152 into the cavity 190 of the produce seat, and thus the produce positioned within the seat during operation. In one embodiment, the stops 192 are adjustable to allow any number of lengths 194 to control the penetration of the cutter 152 into the cavity 190.

[0055] The stops 192 can be positioned in substantially any position to stop movement, including on or around one or more supports 166, attached to the press plate 154, attached with the lid 178, within the housing to contact the base support plate 170 or other such positioning to halt the movement of the produce seat 152. The adjustment of the stops can be provided through substantially any number of ways including adding or removing segments of the stop 192, telescoping of the stops, thread screwing along the supports 166 and substantially any other means for adjusting.

[0056] In one embodiment, the stops 192 are one or more sleeves or partial sleeves positioned around and axially aligned with a support. The support plate moves along the first axis 180 towards the housing 172 until the support plate 164 contacts the stops halting the movement of the produce seat and produce. The partial sleeves include longitudinal grooves along a length allowing sleeves to be added or removed from about the supports without disassembly of the apparatus. As one example, the stop sleeves can be in contact with the lid and thus limit the movement of the seat when the support plate contacts the stop sleeves. A plurality of sleeves stacked together can be employed to provide a desired range of motion for the seat along the first axis 180 and thus a desired penetration of the cutter into the produce.

[0057] In one embodiment, the stops can be thread screwed onto the supports proximate the support plate 164. The stops can be screwed away from the support plate to limit the range of motion or screwed towards the support plate to enlarge the range of motion.

[0058] FIG. 4 shows a simplified block diagram of an elevated view of the produce seat 156 and FIG. 5 depicts a cross-sectional view of the produce seat 156 according to one embodiment of the present invention. In one embodiment, the produce seat is concaved to aid in maintaining positioning of the produce within the seat 156 during coring. In one embodiment, the produce seat is bowl shaped having a generally tapering cylindrical shape that tapers from an open portion 220 to a base 222. The open portion has a diameter 153 that is sufficiently large to receive produce. Typically the diameter 153 is selected to be at most greater than the diameter of the produce harvested by 140%. Further, the diameter should not less than 98% of the produce being harvested. In one embodiment, the produce seat 156 is detachable, allowing any number of different sized produce seats to be incorporated into the apparatus 150. The cavity 190 of the produce seat 152 has a depth 226 that is sufficiently deep to receive and maintain a produce within the seat. The produce seat 152 shown in FIGS. 4 and 5 has a cylindrical shape, however, it will be apparent to those skilled in the art that substantially any shape can be utilized that receives and aids in maintaining produce within the seat 152, such as cubical, oval, pyramid, octagonal and other such shapes.

[0059] FIG. 6 depicts a simplified elevated view of one embodiment of the press plate 154. The press plate includes the cutter aperture 188 that is greater than the width or rotational diameter of the cutter 334 (see FIG. 13). Additionally, as described above, the width or diameter 155 of the press plate is typically greater than the diameter 153 of the produce seat 152. This allows a user of the apparatus 150 to easily access the press plate in order to apply pressure to the press plate forcing the produce seat 152 over cutter 162 and thus the produce within the seat onto the cutter 162. The press plate 154 shown in FIG. 6 has a round shape. However, it will be apparent to one skilled in the art that the press plate can have substantially any shape including generally triangular, square, rectangular, oval and substantially any shape.

[0060] FIG. 7 shows an elevated view and FIG. 8 shows an elevated side view of one embodiment of the cutter guard 160. In the embodiment of the cutter guard shown in FIGS. 7-8, the cutter guard has generally a "U" shape. The mouth 240 of the cutter guard is passed around the cutter 162 and shaft 210, and the cutter and shaft are position within the cutter guard to provide protection from and for the cutter 162. In one embodiment, the cutter guard does not completely surround the cutter and shaft. In stead, a gap, defined by the mouth 240 of the generally "U" shaped cutter guard 160 is open. This allows cutting from the produce being cored to be removed while the apparatus 150 is in operation. As such, the apparatus 150 can be continuously operated to core a plurality of products while avoiding excess cuttings building up and jamming the cutter 162 and avoiding the need to disassemble the apparatus 150 to remove produce cuttings.

[0061] It will be apparent to those skilled in the art that the cutting guard 160 can have substantially any shape to provide protection from and for the cutter 162 including open rectangular, open triangular and substantially any other shape.

[0062] Further, a portion of the mouth 240 can be covered to provide additional protection to and from the cutter 162 while another portion remains open to allow extraction of the produce cuttings. For example, a first half 242 of a height 246 of the guard 160 can be covered while a second half 244 is open. In one embodiment, the cutter guard 160 simply comprises a plurality of posts extending between the support 164 and the press plate 154.

[0063] FIG. 9 shows an elevated view of a support plate 164 according to one embodiment of the present invention. In the embodiment shown in FIG. 9, the support plate 164 has generally "U" shaped gap 260 that has similar dimensions as an inner wall 248 of the cutting guard 160. As such, the cutting guard is positioned in contact with and aligned with the support plate 164. The support plate includes one or more support seats 262.

[0064] The support seats are configured to receive the one or more supports 166 and maintain the positioning of the

supports relative to the support plate **164**. The support seats **262** can be extensions from the surface **264** of the support plate or can be recesses within the surface of the support plate. Additionally, the support seats can be rivets or bolts extending through the support plate **164** to be received by the supports **166** to secure the supports with the support plate **164**.

[0065] The support plate **164** shown in **FIG. 9** has a generally triangular or "A" shape. However, the support plate can have substantially any shape that is capable of receiving the one or more supports **166** and maintaining the stability and positioning of the supports. Further, the gap **260** can be any shape that allows the shaft **210** to extend through the support plate **164**. For example, the gap can be simply a round aperture just large enough through which the shaft passes.

[0066] **FIG. 10** depicts a simplified elevated view of the housing lid **178** according to one embodiment. The lid includes one or more support apertures **174** that allow the supports to extend through the lid **178** to be secured with the base support plate **170**. The lid includes one or more linear motion flange mounts **271** for mounting the linear motion flanges **176**. In one embodiment, the lid includes support aperture seals **270**. The seals are secured to the lid and have an aperture with dimensions and shape similar to that of the supports **166** to prevent debris, dirt and dust from entering the housing **172**. The lid **178** further includes a shaft aperture **272** that allows the shaft to extend out from the housing to the cutter **162**.

[0067] In one embodiment, the lid additionally includes one or more extension resistance device mounts **274**. These mounts **274** aid in securing the extension/compression resistance devices **184**. The extension resistance mounts **274** can be implemented through any number of devices for mounting the extension resistance devices **184** depending on the type of extension resistance devices utilized. For example, the extension resistance mounts **274** can be simple apertures allow bolts to extend through to secure the extension resistance devices. The extension resistance mounts **274** can be hooks, rivets and substantially any other device for mounting. In one embodiment, the lid **178** can further include one or more apertures **276** for securing the shaft bearing/seal **218**.

[0068] The lid **178** can have substantially any shape. Typically, the lid has a shape similar to the housing **172** to close off the housing preventing debris from getting into the housing. In one embodiment, the lid has a convex shape such that the center of the lid extends towards the cutter **162**. As such, portions of the produce that are cored and fall onto the lid slide off and do not interfere with the motion of the support plate **164** and thus produce seat **152**. Alternatively, the housing **17** and lid **178** can be configured at an angle such that the cored material slides off the lid.

[0069] **FIG. 11** depicts a simplified elevated view of one embodiment of the base support plate **170**. In the embodiment shown, the base support plate is generally "U" shaped. The mouth of the "U" shape has a sufficient width **280** to allow the base support plate **170** to move along the first axis **180** without contacting the motor **212** and any other components or devices within the housing **172**. Other components can include wiring, hydraulic hoses, a control unit **286** (see **FIG. 3**) and other such components. The base support plate **170** includes one or more support mounts **282**. The support mounts receive the supports **166** for mounting and securing the supports with the base support plate **170**. In one embodiment, the base support plate additionally includes one or more expansion/compression resistance device mounts **282** for mounting and securing the expansion resistance devices **184** to the base support plate providing resistance to the movement of the base support plate **170** away from the lid **178** along the first axis **180**. The base support plate **170** can have substantially any shape so that the base support plate avoids contacting other components within the housing that would hinder or prevent the movement of the base support plate along the first axis **180**. In one embodiment, the base support plate **176** is positioned on the opposite side of the motor **212** as the lid **178**. As such, the shape of the base support plant can be altered to potentially increase stability.

[0070] **FIG. 12** shows a simplified cross-sectional view of a support **166** according to one embodiment of the present invention. The support can included mounting extensions **290** at either end of the support **166** to be received by the support seat **262** of the support plate **164** and the support mount **282** of the base support plate **170**. The supports **166** can additionally include an inner bore **292** at each end. The bores **292** can be configured to receive a bolt, rivet or other device for securing the support with each of the support plate **164** and the base support plate **170**. For example, the bore **292** can be threaded to receive a bolt screwed through the support plate and into the bore. Alternatively, the extensions **290** can be configured to extend through the support plate **166** and base support plate **170**. One or more bores can extend into or through the supports **166** in a direction generally perpendicular to the bores **292** shown in **FIG. 12**. As such, the extensions **290** protrude beyond the support plate **166** or base support plate **170** to expose the perpendicular bores. The perpendicular bores can then receive rivets, bolts pins or other devices to secure the supports.

[0071] **FIG. 13** depicts an elevated view of one implementation of a cutter **162** according to one embodiment of the present invention and **FIG. 14** depicts a simplified block diagram of an elevated view of the cutter **162** perpendicular to the view shown in **FIG. 13** according to one embodiment of the present invention. The example of the cutter shown in **FIGS. 13 and 14** includes two blades **310** and **312**, where the first blade **310** is shown with the cutting edge facing out of the page and the cutting edge of the second blade **312** is facing into the page. The blades **310,312** are configured such that during cutter rotation a first portion **320** of the blade **310, 312** crosses a plane **330** (see **FIG. 14**), for example a plane parallel with the paper and axis **314** in **FIG. 13** (perpendicular to the paper in **FIG. 14**) prior to a second portion **322** of the blade crossing the plane. The width **334** of the cutter **162** is defined in one embodiment as the maximum distance **334** between cutting edges **326** of the two blades **310, 312**. The width **334** can be configured to be substantially any size to provide accurate coring of the produce. The shape of the cutter can additionally be substantially any shape to achieve the desired coring.

[0072] Still referring to the embodiment shown in **FIGS. 13 and 14**, the blade **310** extends along a center support **324**. The cutting edge **326** of the first portion **320** of the blade **310** crosses the plane **330** prior to the cutting edge of the second portion **322**. In one embodiment, each blade **310,312** is

slightly twisted from a plane parallel with and aligned with both blades **310, 312** such that the first portion **320** of the blades cross the plane prior to the second portion **322**. In one embodiment, the blades have a helix shape where the distance between cutting edges **326** of each blade is the largest diameter of the cutter. As one example, the blade can be configures similar to a spade drill.

[0073] In one embodiment, the cutter **162** includes a point **332** that extends from the center support **324**. The point **332** can be a continuous portion of the center support or can be a separate unit that is secured with the center support. The point is provided, at least in part, to initially contact the produce during coring to initiate penetration into the produce.

[0074] A mounting post **336** extends from the center support **324** to secure the cutter **162** with the shaft **210**. The mounting post **336** can be a continuous portion of the center support or can be a separate unit secured to the center support **324** and blades **310,312**. In one embodiment, the mounting post **336** has a diameter **340** that is less than a bore diameter **366** (see **FIG. 16**) of the shaft **210** or extension shaft **216**.

[0075] As such, the mounting post is inserted within the shaft bore **360**. The mounting post **336** includes one or more bores **328** extending into the mounting post to receive bolts, rivets, pins or screws that are screwed through matching apertures **364** formed within the shaft **210** to secure the cutter **162** with the shaft.

[0076] **FIG. 15** shows a cross-sectional view of a base **342** of the mounting post **336** according to one embodiment of the present invention. The base can include a flat portion **344**. The flat portion **344** mates with a flat portion of a bore **360** within the shaft **210** to aid in stability and alignment, holds the cutter in position, and drives the cutter providing improved rotational torque to the cutter **162** by the shaft **210**. Set screws can be used to secure and locate the cutter with the shaft and aid in driving the cutter.

[0077] **FIG. 16** depicts a plain view of the extension shaft **216** according to one embodiment of the present invention. The extension shaft includes a first bore **360** for receiving and securing the mount post **336** of the cutter **210**. **FIG. 17** shows one embodiment of a cross-sectional view of the extension shaft **216** and first bore, where the first bore includes a flat portion **361** to engage the flat portion **344** of the cutter **162**. Referring back to **FIG. 16**, the extension shaft **216** additionally includes a second bore **362** for mounting and securing to the motor shaft **214**. The extension shaft can include one or more securing apertures **362** in one or both of the bores **360, 362** to allow a bolt, rivet or other securing device to be passed through to contact the mounting post **336** or motor shaft **214**. In one embodiment, the securing apertures **364** match with securing apertures **338** within the mounting post **336** and/or motor shaft **214** such that a bolt, pin, rivet or the like mates with and secures the mounting post and/or motor shaft.

[0078] Referring back to **FIG. 3**, the apparatus **150** typically includes a plurality of supports **166**, for example three supports distributed over an area of the support **164** and lid **178** of the housing **172**. Typically the supports are substantially parallel and axially aligned with the first axis **180**. The supports are also substantially parallel with the shaft **210**. Typically, the supports are equally distributed about the support **164** providing stability and equal distribution of pressure.

[0079] The pieces or sub-units of the apparatus **120, 150**, such as the produce seat **152**, press plate **154**, seat supports **156**, cutter guard **160**, cutter **162**, support plate **164**, supports **166**, base support plate **170**, housing **172**, linear motion flanges **176**, lid of the housing **178** and other sub-units or pieces can be constructed from one or more of substantially any material including plastic, aluminum, steel, steel alloy, tin, iron, titanium and substantially any other material or combination of materials capable of providing the rigidity and stability needed to operate the apparatus **150** and core produce. The pieces do not have to all be constructed of the same material, for example, the produce seat can be plastic while the shaft and cutter are constructed from steel or a steel alloy.

[0080] The pieces or sub-units can be secured together through substantially any method for securing, including rivets, bolts, welding, epoxy, resin, press-fit, snap-fit, hook-and-loop, tongue-and-groove and substantially any other method for securing. Typically, several different methods for securing are utilized in constructing the apparatus **120, 150**, for example, the produce seat **152** may be welded with the cutter guard **160**, and the supports **166** are secured with the support plate **164** with bolts. In some embodiments, more than one method for securing is utilized to secure two pieces. For example, both an epoxy and a bolt can be used to secure the support **166** with the support plate **164**.

[0081] **FIG. 18** depicts a simplified flow diagram of a process **420** for harvesting and preparing produce for shipment. In step **422**, a picker or a machine picks or harvests the produce **122**. In step **424**, the produce is delivered to a processing or harvesting vehicle **510** (see **FIG. 19**, additionally see FIGS. **20-29**). In one embodiment of the process **420**, the produce is trimmed or cut to remove excess stock, stem, leaving and other unwanted portions of the produce in step **425**. In step **426**, the produce is delivered to a coring apparatus operator or to the coring apparatus **150**. In step **432**, the produce is deposited into the produce seat **152** with the section of the produce to be cored positioned and aligned with the cutter aperture **186** of the produce seat such that the section of the produce to be cored is facing and in alignment with the cutter **162**. In step **434**, the produce is secured within the produce seat. In one embodiment, the operator simply applies pressure on produce.

[0082] In step **436**, it is determined if the cutter is rotating. If the cutter is not rotating, the process proceeds to step **438** where rotation of cutter is initiated. If the cutter is rotating in step **436** and following step **438**, the process **420** proceeds to step **440** where movement of the produce and produce seat towards the cutter is initiated, for example, by the operator applying pressure to the press plate **154**. In one embodiment, steps **438** and **440** are a single step where applying pressure on the pressure plate initiates rotation of the cutter **162**.

[0083] In step **442**, the positioning of produce is maintained within the seat by the operator apply pressure on the produce. In step **444**, the movement of the produce seat and produce towards the cutter is continued such that the produce is caused to contact the cutter. In step **452**, the movement of the produce is continued forcing the produce

onto the cutter to core the produce to a desired penetration depth **146** (see **FIG. 2**), for example, continuing to apply pressure on the press plate while maintaining positioning of the produce within the seat. In step **454**, it is determined if the produce is completely cored. For example, it is determined if the support plate **164** has contacted the stops **192** and thus the cutter has extended into the produce to a desired depth. If the produce is not completely cored, the process returns to step **452** where pressure is continued to be applied on the press plate. If, in step **454**, the produce is cored, the process proceeds to step **462**.

[0084] In step **462**, the pressure on press plate is released or reduces to allow the produce seat and produce to retract away from cutter. In step **464**, the cored produce is washed, for example by the operating using a pressure hose delivering a washing solution or transferring the produce to a washer or washing system **732** (see **FIGS. 25 and 26**). In one embodiment, the cored produce is placed on a conveyer belt that passes the cored produce through the washing system. In step **466**, a washing agent is applied to the produce. For example, a stream of cleaning solution is sprayed over the produce. For example, the cleaning solution can include a mixture of water and Chlorine in a concentration of 20 to 500 part per million (ppm), preferably a concentration of 30 to 100 ppm, and more preferably 50 to 70 ppm.

[0085] In step **474**, the cored produce is packaged for shipment. In one embodiment, packaging includes wrapping and/or boxing the cored produce. In step **476**, the packaged produce is transferred from the fields where it was harvested to a customer for use or sale, or transferred to a processing plant for further processing.

[0086] **FIGS. 19 and 20** depict an elevated view and a cross-sectional view, respectively, of an agricultural harvesting vehicle **510** according to one embodiment of the present invention. Typically, the harvesting vehicle **510** includes an engine **512** to provide self propulsion. The engine **512** couples with a drive shaft (not shown) that further couples with and causes rotation of one or more motion or movement devices such as wheels or track belts **514**. The wheels are spaced to fit within furrows **516** of a plowed field so as not to disturb or damage the furrows **516** and crops growing in the fields. The wheels **514** are additionally fixed with and support a rigid frame **520** that provides structure and support for the vehicle **510**. A vehicle operator is positioned in an operator platform **518** to steer and control the speed of the vehicle.

[0087] The frame **520** supports one or more continuous belts or conveyors **522**. The conveyors extend along an axis **524** that is generally perpendicular to the vehicle's direction of travel indicated by an arrow labeled **226**. The conveyors can be formed from rubber, canvas, leather, metal gratings, links and the like, and can be a sold piece, can be meshed of have other structure. Individuals or pickers picking the produce being harvested travel or walk along the direction of travel **226** behind a first portion of the conveyor **530** that extends out and away from the frame **520**. The pickers cut or pick the produce and place the produce onto the first portion of the conveyor **530**. The conveyor **522** carries the produce to the vehicle to pass between one or more processing stations **540**. Typically, each processing station includes a coring apparatus **542**, which can be similar to the coring apparatuses **120**, **150** as described above (see FIGS. **1-17**). The one or more coring apparatuses are typically secured or mounted on the frame **520**, usually through the housing **172** of the apparatus **150**, to maintain the positioning and stability of the coring apparatus.

[0088] As the picked produce travels along a second portion of the conveyor **532** between processing stations **540**, coring operators operating the coring apparatuses **542** retrieve the produce from the conveyor and insert the produce into the coring apparatus **542** with the portion of the produce to be cored aligned with and facing the cutter. The coring operators depress the produce seat and produce to contact the cutter causing the extraction of the core. In one embodiment, the processing stations **540** additionally include a sprayer or washing wand **544**. The washing wand **544** is coupled through hosing (not shown) to a fluid or wash tank **546**. The wash tank delivers a washing solution, for example a solution of Chlorine and water, to the sprayers **544**. In one embodiment, an air compressor/tank **548** pressurizes the washing solution to force the solution to the sprayers. The air and water washing system provides an even application of the cleaning solution. The operators spray the produce with the washing solution to clean the produce. Alternatively, a plurality of sprayers can be positioned above and/or below the conveyor **522** (for example, at the transition between the first and second portions of the conveyor **530**, **532**) to wash the produce prior to or after the operators retrieve the produce for coring.

[0089] The cored and cleaned produce is then returned to the second portion of the conveyor **532** where the produce is retrieved by one or more packers at one or more packer stations **560**. The packers package the cored and washed produce, for example, inserting the produce into boxes, and in some embodiments, wrap the produce prior to being arranged within the boxes. The packers place the packed boxes back onto the conveyor **522** where it is received by a loading trailer **562**. When the loading trailer **562** is full, it pulls away from the harvesting vehicle **510** to transport the cored produce away from the fields and allows another loading trailer to be positioned to receive the loaded boxes of harvested and cored produce.

[0090] In one embodiment, the operator platform **518** is additionally configured to allow one or more box assemblers to be positioned. The box assemblers assemble boxes or carts and forward the boxes along a box rack **564**. The box rack **564** is positioned on the vehicle **510** to allow the packers to retrieve empty boxes to fill with the cored produce.

[0091] In one embodiment, the vehicle operator additionally controls the speed of the conveyor **522** to avoid uncored produce from passing all of the processing stations **540**. In one embodiment, the first portion of the conveyor **530** is hinged at approximately an intersection between the first and second sections **530**, **532** of the conveyor to allow the first portion to be raised to avoid obstacles and roads, or for other reasons.

[0092] FIGS. **21**,**22**,**23** and **24** depict an elevated view, a cross-sectional view along an axis **581**, a rear elevated view and a side elevated view, respectively, of a harvesting vehicle **580** according to one embodiment of the present invention. The vehicle **580** is removably attached with a motorized vehicle **582**, such as a tractor or other vehicle

capable of pulling the harvesting vehicle **580**. Alternatively, the harvesting vehicle **580** can include and engine coupled with a drive shaft that drives one or more movement devices, such as wheels **584**, to move the vehicle **580** through the fields. The wheels are spaced to fit between furrows **586** so as not to damage unpicked produce and the furrows. An operator is positioned on the tractor **582** or an operator platform if the vehicle **580** includes an engine for self propulsions.

[0093] The vehicle includes one or more lateral conveyors **610** and **612**. A first and second conveyor **610,612** extend out from the vehicle **580** generally perpendicular to the direction of travel of the vehicle indicated by arrow **616**. The conveyors **610, 612** continuously loop in a direction towards the vehicle. Pickers travel in the direction of travel behind the conveyors and pick the produce. The pickers place the produce onto the conveyor where the produce is delivered to a central conveyor **614**. The central conveyor loops in the direction of travel moving the picked produce in the direction of travel to pass one or more processing stations **620**. In the embodiment shown in **FIG. 21** there are 10 processing stations **620**. However, it will be apparent to one skilled in the art that any number of processing stations can be included to maximize efficiency of harvesting. Typically, each processing station includes a coring apparatus **622** that is similar to the coring apparatuses **120, 150** previously described (see FIGS. **1-17**). A coring operator is positioned at each processing station **620**. The coring operators retrieve produce from the central conveyor **614** and position the produce over the cutter aperture proximate the cutter with the portion of the produce to be cored facing the cutter. The coring operator causes the produce to contact the cutter causing the cutter to core the produce.

[0094] In one embodiment, the vehicle includes one or more washing devices or wands **624** at each processing station **620** or between every other processing station to be shared by two coring operators. The coring operator washes the produce, either before or after coring. Hoses (not shown) couple between the washing wands **624** and a washing solution tank **630** to carry washing solution to the wash wands. In one embodiment, one or more hoses additionally couple between an the washing solution tank **630** and an air tank and/or compressor **632** to pressurize the washing solution to deliver the washing solution to the washing wands.

[0095] In one embodiment, the vehicle **580** includes a washing device (not shown). For example, the washing device can be positioned at the junction of the first and second lateral conveyors **610,612** with the central conveyor **614**. The washing device washes the produce prior to delivery to the coring operators. The washing device can include a plurality of sprays, a bath, a combination of spray and bath or other such configurations for washing.

[0096] Once the produce is cored and washed, the coring operators return the cored produce to the central conveyor **614**. The central conveyor continues to carry the produce in the direction of travel **616** to one or more packaging stations **640**. Typically, a packager is positioned at each packaging station. The packagers retrieve the cored produce from the central conveyor **614** and package the produce in cartons or boxes. Once a carton is full, the packager places the full carton **646** onto a track, conveyor or series of rollers **642**. The rollers **642** deliver the full carton to a third lateral conveyor **644** or another track or series of rollers. The third lateral conveyor **644** forwards the full cartons to a loading trailer or vehicle **650**. In one embodiment the third lateral conveyor **644** includes an elevated portion **648** that elevates the full cartons **646** to be delivered to the loading vehicle **650**. Once the loading trailer is full with full cartons, the loading trailer pulls way from the harvesting vehicle **580** to allow another loading trailer to be positioned proximate the third lateral conveyor **644** to receive full cartons.

[0097] In one embodiment, the first, second and third lateral conveyors **610,612** and **644** are hinged **652** to allow first ends **662** of the conveyors to be lifted to avoid obstacles. In one embodiment, the first and/or second lateral conveyors **610, 612** are segmented to allow the length **654** of the conveyor to be increased or decreased by extending or retracting the first ends **662** of the conveyors away from or towards second ends **660** of the conveyors secured with the vehicle **580**. The first, second and third lateral conveyors **610, 612,** and **644** are typically detachably secured with the frame of the vehicle **580** to allow one or all of the conveyors to be removed.

[0098] **FIGS. 25 and 26** depict an elevated view and a cross-sectional view, respectively, of a harvesting vehicle **700** according to one embodiment of the present invention. The harvesting vehicle **700** is removably secured to a tractor or other motorized vehicle **702** for pulling the harvesting vehicle **700** in a direction of travel indicated by an arrow labeled **704**. The direction of travel is parallel with furrows **706** of the field being harvested. The harvesting vehicle can be secured with the tractor **702** through substantially any coupling including a three-point hitch or other such coupling.

[0099] The harvesting vehicle **700** includes a conveyor **710**. The conveyor typically is positioned generally perpendicular to the direction of travel **704**. The harvesting vehicle **700** additionally includes one or more coring stations **716**. The coring stations **716** are disburse along a first section **712** of the conveyor **710**. Each coring station **716** includes a coring apparatus **720**. The coring apparatus is similar to the coring apparatus **120, 150** as described above (see FIGS. **1-17**).

[0100] Picker tables **722** are additionally disbursed along the first section **712** of the conveyor. Pickers or individuals cutting the produce, represented by triangles labeled **724**, follow the harvesting vehicle **700** picking produce. The pickers **724** place the cut produce onto the picker tables. In one embodiment, the pickers additionally trim the cut produce to remove extraneous portions of the cut produce. Typically, a coring operator is positioned at each coring station **720**. The coring operators take cut produce from the cutting table and position the produce in the coring apparatus. In one embodiment, the coring operator secures the produce within the coring apparatus with the portion of the produce to be cored proximate a cutting device or blade of the coring apparatus **720**. The coring operator initiates coring by moving the produce to contact the cutting device. The coring operator continues to move the produce onto the cutting device until the cutting device extends into the produce to a desired depth. The coring operator then places the cored produce onto the conveyor **710**.

[0101] The conveyor carries the produce in a direction signified by arrows labeled **730** to pass through a washing

unit **732**. The produce passes through the washing unit and is washed with a washing solution. The washing solution can be water, water and Chlorine or other washing solutions. In one embodiment, the washing unit includes a plurality of pressure nozzles that spray the cored produce with the cleaning solution. Alternatively or additionally, the cored produce is passed through a cleaning solution bath. In one embodiment, the cleaning solution sprayed over the cored produce is collected and recycled through the washing unit to be reused to spray additional cored produce.

[0102] The washing unit is coupled through hoses (not shown) to a cleaning solution tank **734** that stores the cleaning solution (and, in one embodiment, recycled cleaning solution). An air compressor **736** stores air in a pressurized air tank **738**. The air tank is coupled through hoses to the cleaning solution tank **734** and the washer unit **732** to provide pressure to force the washing solution from the sprayers.

[0103] Following the washing unit **732**, the conveyor **710** forwards the cored and washed produce to a second elevated section **714** of the conveyor **710**. The second section **714** carries the cored and washed produce to an elevation greater than one or more collection bins **740** positioned on a loading trailer **742**. The second section **714** of the conveyor terminates in dispensers **744** at the bins to drop the cored and washed produce into the bins **740**.

[0104] In one embodiment, a hydraulic power source **746** is included on the harvesting vehicle **700** or tractor **702**. The power source **746** couples with the coring apparatus **720**, compressor **736**, pumps (not shown) for recycling cleaning solutions and other devices on the vehicle **700** utilizing power.

[0105] Typically, the first and second sections of the conveyor **712, 714** are removably secured with the harvesting apparatus **700**. Further, the first and second sections of the conveyor are secured with the harvesting apparatus **700** through hinges **750**. The hinges allow the first and second sections to be elevated to avoid obstacles and for storage. Additionally, the hinging on the second section **714** of the conveyor **710** allows the second section to be elevated to one of a plurality of heights to accommodate any number of different heights of loading trailers **742** and/or bins **740**.

[0106] FIGS. **27-29** show an elevated view, cross-sectional view and a rear view, respectively, of a harvesting apparatus **780** according to one embodiment of the present invention. The harvesting vehicle **780** is removably secured with a loading vehicle or trailer **782**. The loading vehicle can include an engine for propelling the loading vehicle **782** and harvesting vehicle **780**, or the loading vehicle can be further removably secured with a tractor **784** or other vehicle capable of pulling both the harvesting vehicle **780** and loading vehicle **782**. In one embodiment, the harvesting vehicle includes an engine for providing self propulsion for the harvesting vehicle such that the harvesting vehicle simply follows the loading vehicle **782**.

[0107] The harvesting vehicle **780** includes one or more picker tables **790**. Pickers or individuals cutting the produce **792** follow the harvesting vehicle **780** and pick or cut produce. The pickers place the cut produce onto the picker tables **790**. In one embodiment, the pickers cut extraneous and unwanted portions off of the cut produce. The harvesting vehicle **780** further includes one or more coring stations **794**. Each coring stating **794** includes a coring apparatus **796**. The coring apparatuses can be similar to the coring apparatus **120, 150** as described above (see FIGS. **1-17**).

[0108] Coring operators are positioned at the coring apparatuses **796** and retrieve picked produce from the picker table **790**. The produce is positioned in the coring apparatus **796** and cored by forcing the produce onto a cutting device or blade. In one embodiment, the coring stations additionally include wash sprayers **800**. The wash sprayers couple through hoses (not shown) to a cleaning solution tank **802**. An air tank and/or compressor **804** couples with the solution tank **802** and/or sprayers to provide pressure to the sprayers.

[0109] The cored produce is placed on a cored produce table **806**. One or more packing stations **810** are positioned proximate the produce table. One or more packing operators are positioned at the packing stations. The packing operators retrieve the cored produce from the produce table **806** and package the produce into crates. Once the crates are full, the packing operators transfer the crates to a conveyor, track, slide, series of rollers or other device for moving the full crates **812**. The series of rollers **812** are positioned on the harvesting vehicle **780** such that the full crates are transferred towards the loading vehicle **782**. On the loading vehicle, loaders transfer and arrange the full crates to the loading vehicle **782**.

[0110] The coring apparatus **120, 150** of the present invention can be implemented on a harvesting vehicle to provide processing of the produce prior to the produce being transported to a processing plant, vendor or distributor. The coring apparatus can be a stand alone device transportable to a location, such as fields being harvested. Picked produce can be delivered to the stand alone coring apparatus where it can be cored. The coring apparatus **120, 150** can be implemented in a processing plant as part of produce preparation for shipment. The apparatus can also be implemented in a processing assembly that prepares produce for distribution and sales. For example, a company selling frozen vegetables can implement the coring apparatus in an assembly line preparing produce to be processed and prepared for freezing.

[0111] The coring apparatus and method of the present invention reduces the amount of damage produce experiences during processing. The present method and apparatus additionally improves the quality of the produce by being able to process the produce in the fields. Further, the present invention provides accurate coring to optimize the amount of usable produce.

[0112] While the invention herein disclosed has been described by means of specific embodiments and applications thereof, numerous modifications and variations could be made thereto by those skilled in the art without departing from the scope of the invention.

What is claimed is:

1. An apparatus for coring produce, comprising:

a produce seat having a cutter aperture, wherein the produce seat is configured to receive produce to be cored such that the portion of the produce to be cored is positioned and aligned with the cutter aperture;

a cutter is secured with a shaft, the shaft being rotationally coupled with a motor configured to cause the shaft and cutter to rotate, wherein the cutter is aligned with the cutter aperture; and

a support being configured to position the produce seat such that the produce seat is positioned proximate the cutter and the cutter aperture is aligned with the cutter, wherein the support is configured to allow the produce seat to be moved from a first position where the produce seat is proximate the cutter, to a second position such that at least a portion of the cutter extends through the cutter aperture, and to allow the produce seat to be returned to the first position.

2. The apparatus for coring produce as claimed in claim 1, further comprising:

a cutter guard secured between produce seat and the support positioning the produce seat relative to the cutter as dictated by the positioning of the support, wherein the cutter guard at least partially surrounds the cutter when the produce seat is in the first position.

3. The apparatus for coring produce as claimed in claim 1, further comprising:

a compression/extension resistance device configured to resist the movement of the produce seat from the first position to the second position and to return the produce seat from the second position to the first position.

4. The apparatus for coring produce as claimed in claim 1, further comprising:

a press plate secured with the produce seat, the press plate having a cutter aperture aligned with the cutter aperture of the produce seat, such that the cutter extends through both the cutter aperture of the press plate and the cutter aperture of the produce seat when the produce seat is in the second position.

5. The apparatus for coring produce as claimed in claim 1, further comprising:

a housing configured to position the support;

a frame supported by one or more movement devices for allowing movement of the frame over fields to be harvested, wherein the housing is secured with the frame.

6. The apparatus for coring produce as claimed in claim 5, further comprising:

a conveyor supported by the frame and positioned on the frame proximate the produce seat, such that harvested produce is carried by the conveyor towards the produce seat.

7. The apparatus for coring produce as claimed in claim 1, wherein:

the cutter includes a blade positioned on a center support, wherein the blade is configured such that a first portion of a cutting edge of the blade contacts the produce during coring prior to a second portion of the cutting edge contacting the produce.

8. An apparatus for processing harvested produce, comprising:

a motor rotationally coupled with a shaft at a first end of the shaft;

a cutter being secured to a second end of the shaft such that the cutter rotates as the shaft rotates;

a produce seat having a cutter aperture, wherein the produce seat is movable along an axis such that in a first position the produce seat is proximate the cutter and the cutter does not extend through the cutter aperture, and in a second position the cutter at least partially extends through the cutter aperture.

9. The apparatus as claimed in claim 8, further comprising:

a housing configured to house the motor and a base support plate;

the housing having a lid such that the shaft extends through the lid to couple with the cutter;

one or more supports being secured with the base support plate at a first end of the one or more supports such that the one or more supports extend from the base support plate through the lid;

the one or more supports being secured with a support plate at a second end of the one or more supports;

a cutter guard being secured with and between the support plate and the produce seat, wherein the cutter guard at least partially surrounds the cutter when the produce seat is at least in the first position.

10. The apparatus as claimed in claim 9, further comprising:

one or more extension/compression resistance devices secured between the housing and the base support plate to resist the movement of the produce seat from the first position to the second position and to provide a return force to return the produce seat from the second position to the first position.

11. The apparatus as claimed in claim 8, further comprising:

a frame supported by one or more movement devices to provide movement of the frame over produce to be harvested, wherein the motor and produce seat are supported by the frame.

12. A harvesting vehicle for harvesting produce, comprising:

a frame supported by one or more movement devices, wherein the frame provides rigidity and structure to the harvesting vehicle;

one or more processing stations having a coring apparatus, wherein the coring apparatus comprises:

a produce seat having a cutter aperture, where in the produce seat is configured to receive produce such that a portion of the produce to be cored is aligned with the cutting aperture;

a cutter aligned with the cutter aperture; and

one or more supports configured to provide positioning of the produce seat, such that in a first position the cutter does not extend through the cutter aperture and in a second position the cutter extends at least partially through the cutter aperture.

13. The harvesting vehicle as claimed in claim 12, further comprising:

a first conveyor supported by the frame such that the first conveyor is positioned on the frame proximate the one or more processing stations, such that the first conveyor carries produce towards the one or more processing stations.

14. The harvesting vehicle as claimed in claim 13, further comprising:

a second conveyor supported by the frame and extending out from the frame and over a field being harvested, such that the second conveyor carries produce to the first conveyor.

15. The harvesting vehicle as claimed in claim 13, further comprising:

a washing system positioned over the first conveyor, the washing system being configured to deliver a washing solution to contact the produce carried on the first conveyor.

16. A method for coring produce, comprising the steps of:

positioning the produce in a produce seat;

aligning the produce with a cutter aperture of the produce seat;

forcing the produce seat and produce towards the cutter;

causing the cutter to contact the produce;

continuing to force the produce onto the cutter until a desired penetration of the cutter into the produce is achieved providing a cored produce;

forcing the cored produce away from the cutter; and

removing the cored produce from the produce seat.

17. The method as claimed in claim 16, further comprising the step of:

transporting the cored produce away from a field from which the produce was harvested following the step of removing the cored produce from the produce seat.

18. The method as claimed in claim 16, further comprising the steps of:

picking the produce;

placing the produce on a conveyor of a harvesting vehicle; and

retrieving the produce from the conveyor prior to the step of positioning the produce in a produce seat.

19. The method as claimed in claim 16, further comprising the step of directing a spray of washing solution from a washing wand at the produce and washing the produce.

20. The method as claimed in claim 16, wherein the step of continuing to force the produce onto the cutter includes continuing to force the produce onto the cutter until a stop is contacted.

21. An apparatus for processing harvested produce, comprising:

means for receiving and maintaining produce, the means for receiving and maintaining the produce including an aperture;

means for cutting aligned with the aperture;

means for rotating being secured with the means for cutting, such that the means for rotating rotates the means for cutting;

means for supporting the means for receiving and maintaining the produce, wherein the means for supporting allow movement of the means for receiving and maintaining such that in a first position the means for cutting is not protruding through the aperture, and in a second position the means for cutting at least partially extends through the aperture; and

means for resisting movement of the means for receiving and maintaining from the first position to the second position.

22. The apparatus as claimed in claim 21, further comprising:

means for receiving pressure from an operator secured with the means for receiving and maintaining the produce.

23. The apparatus as claimed in claim 21, further comprising:

means for transporting the means for receiving and maintaining, the means for rotating, the means for supporting and the means for resisting across a field to be harvested.

* * * * *

US005566695A

United States Patent [19]

Levey et al.

[11] Patent Number: 5,566,695

[45] Date of Patent: *Oct. 22, 1996

[54] **MODULAR APPARATUS AND METHOD FOR CLEANING CONTAINERS**

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[73] Assignee: **Environmental Sampling Supply, Inc.**, Oakland, Calif.

[*] Notice: The term of this patent shall not extend beyond the expiration dateof Pat. No. 5,409,545.

[21] Appl. No.: **388,376**

[22] Filed: **Feb. 14, 1995**

Related U.S. Application Data

[63] Continuation of Ser. No. 27,115, Mar. 4, 1993, Pat. No. 5,409,545.

[51] **Int. Cl.**[6] **B08B 3/02**; B08B 9/08

[52] **U.S. Cl.** ..... **134/83**; 134/167 R

[58] **Field of Search** ..... 134/22.18, 24, 134/25.4, 46, 49, 50, 56 R, 57 R, 68, 72, 83, 129, 131, 133, 134, 152, 167 R, 168 R, 171; 15/304

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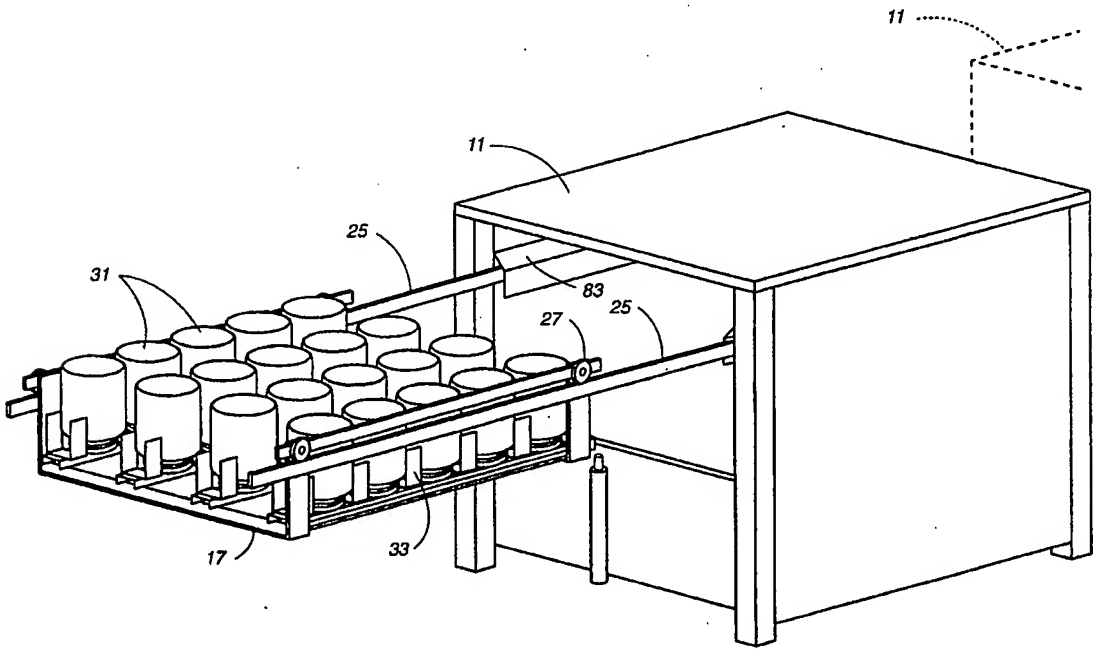
Primary Examiner—Philip R. Coe
Attorney, Agent, or Firm—Donald L. Beeson

[57] **ABSTRACT**

An apparatus and method for cleaning containers, such as sample containers for environmental testing, involves providing fluidly isolated modular cleaning bays which are interchangeably cascaded together for processing trays of containers through different washing and rinsing solutions. In each modular bay a bank of nozzle elements is cycled to traverse into and out of the tray of containers to clean the interior surfaces of the containers.

4 Claims, 16 Drawing Sheets



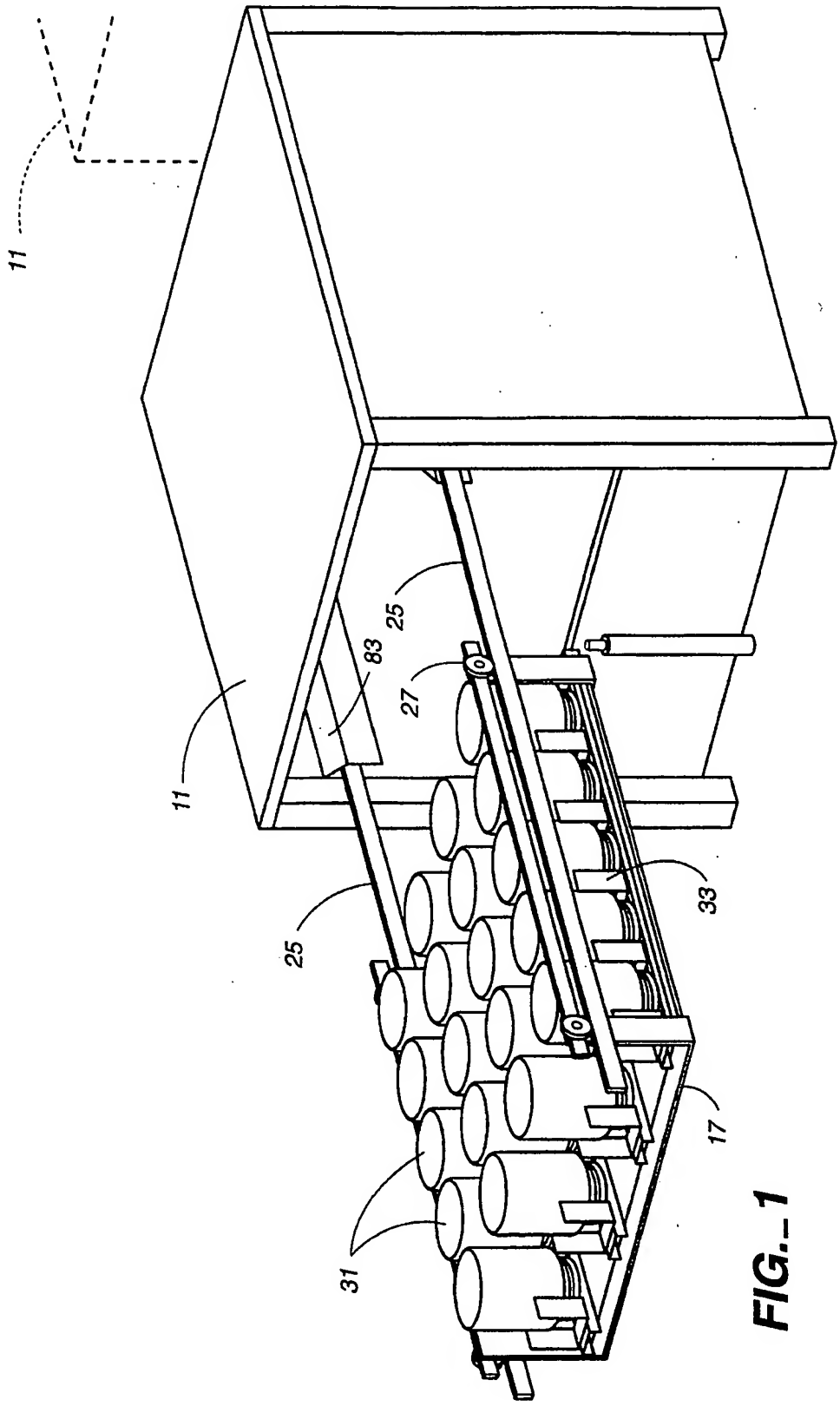


FIG._1

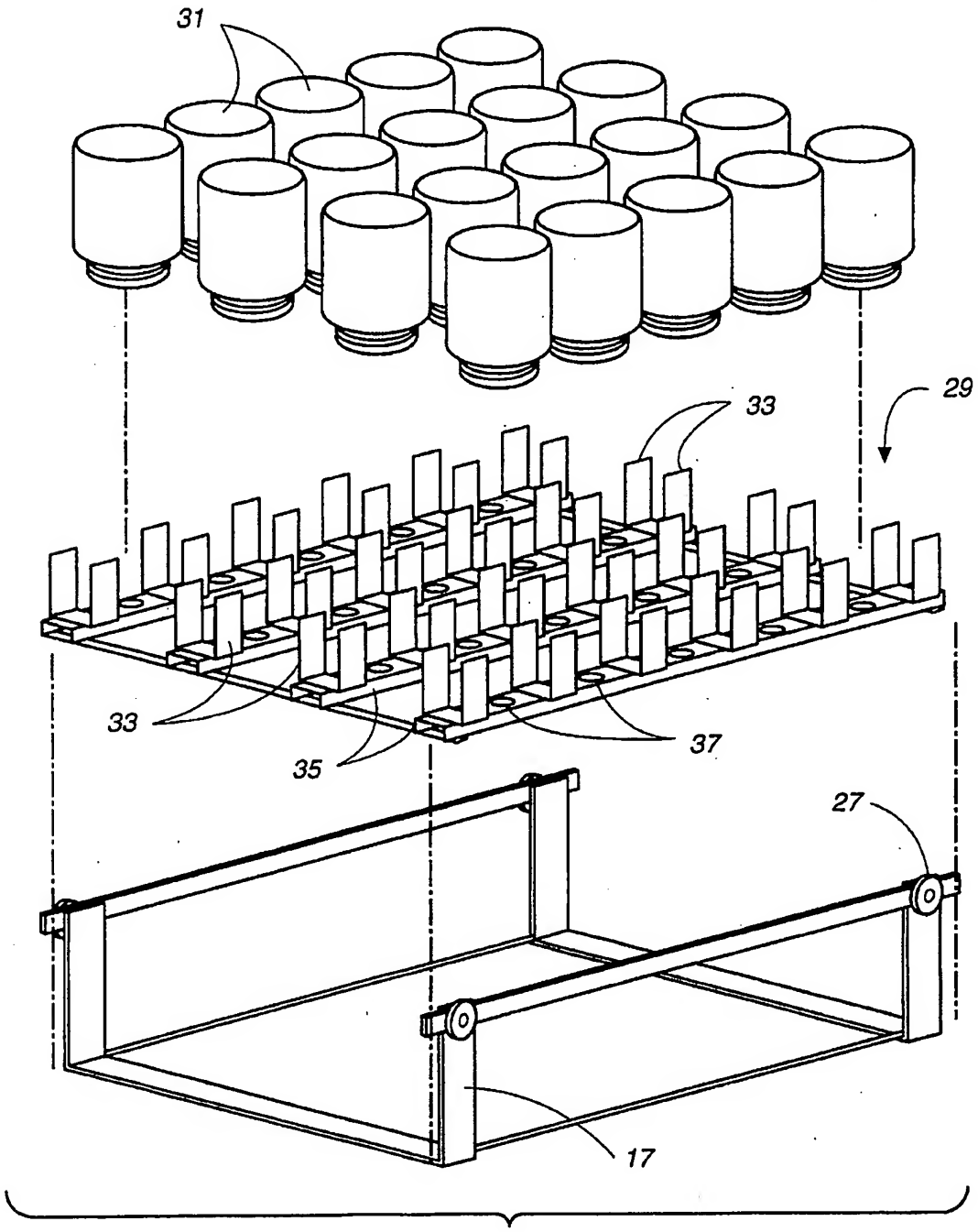


FIG._2

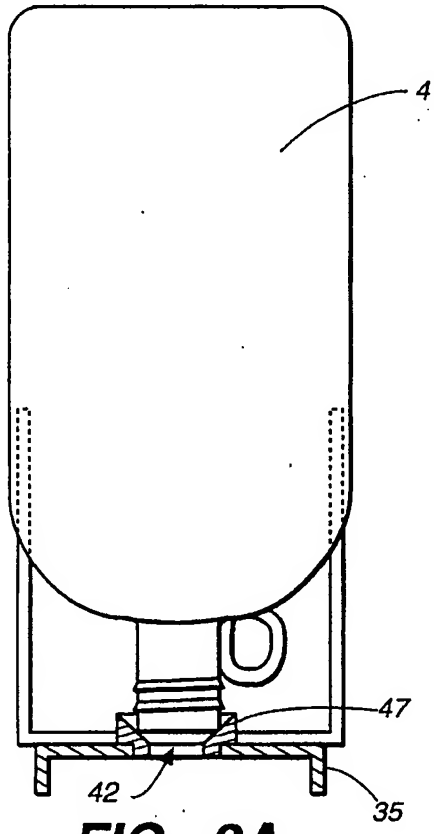


FIG._3A

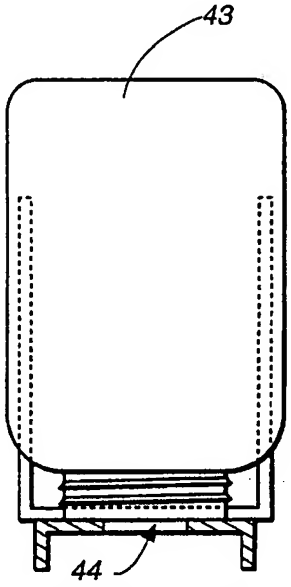


FIG._3B

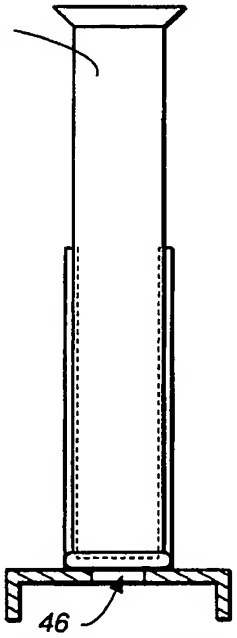


FIG._3C

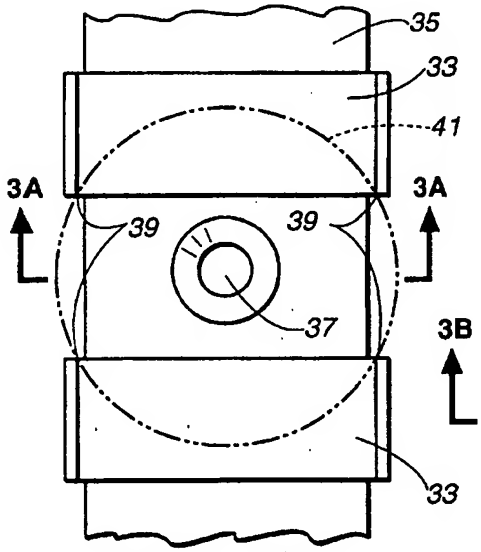


FIG._3D

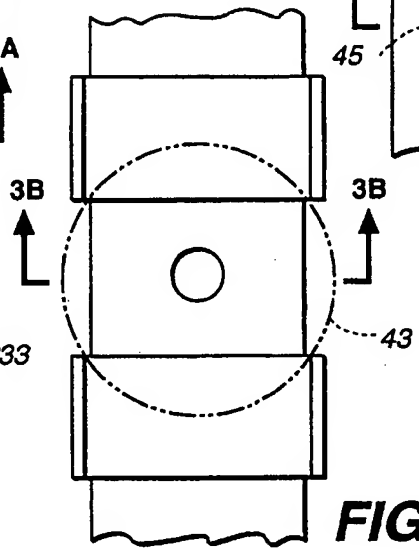


FIG._3E

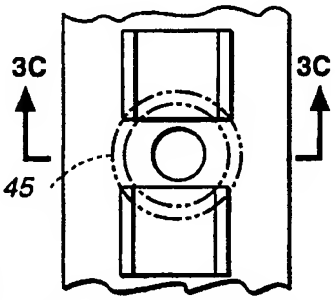


FIG._3F

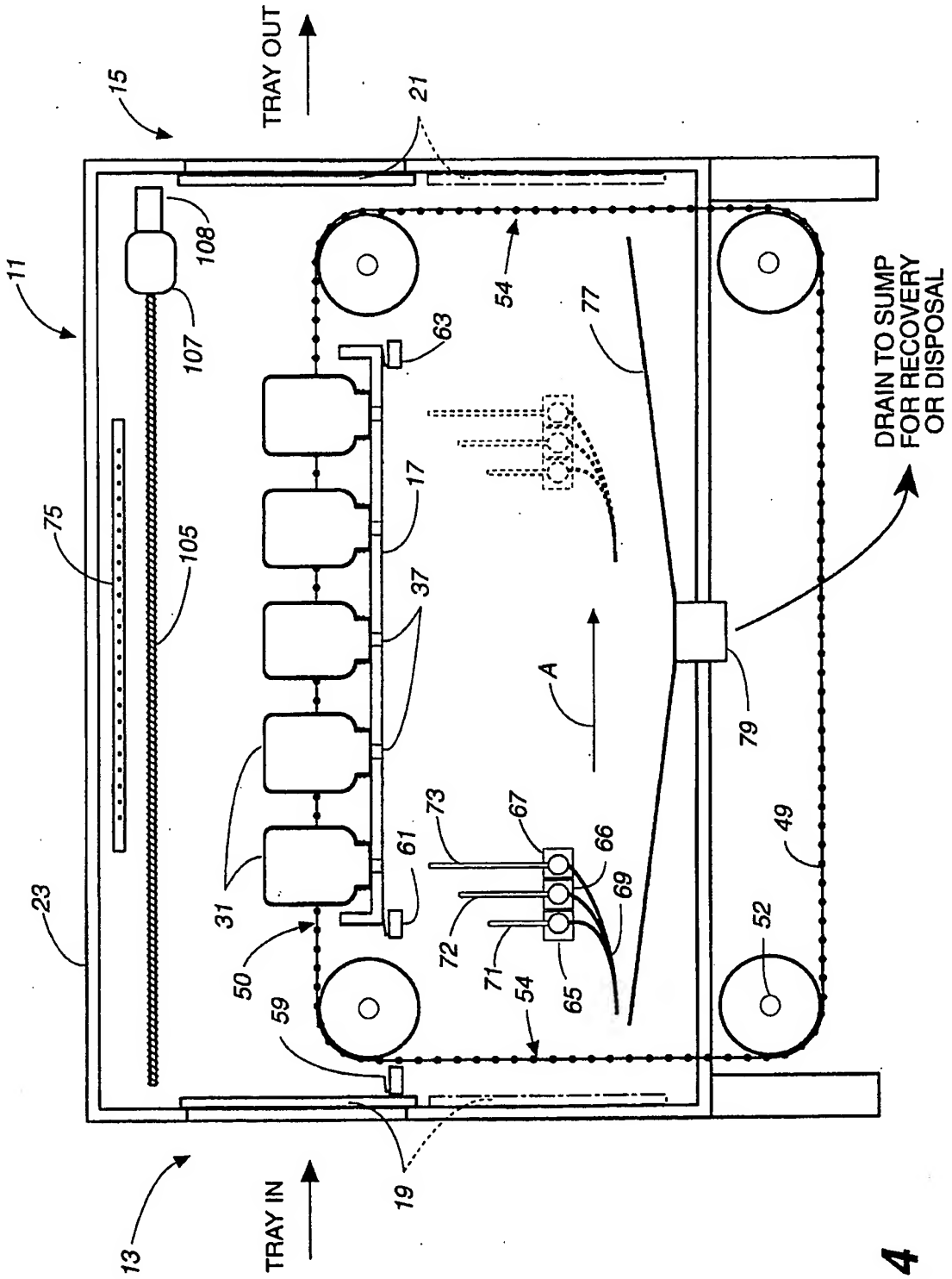

TRAY OUT
TRAY IN
DRAIN TO SUMP FOR RECOVERY OR DISPOSAL
A
11
13
15
17
19
21
23
31
37
49
50
52
54
59
61
63
65
66
67
69
71
72
73
75
77
79
105
107
108

FIG._4

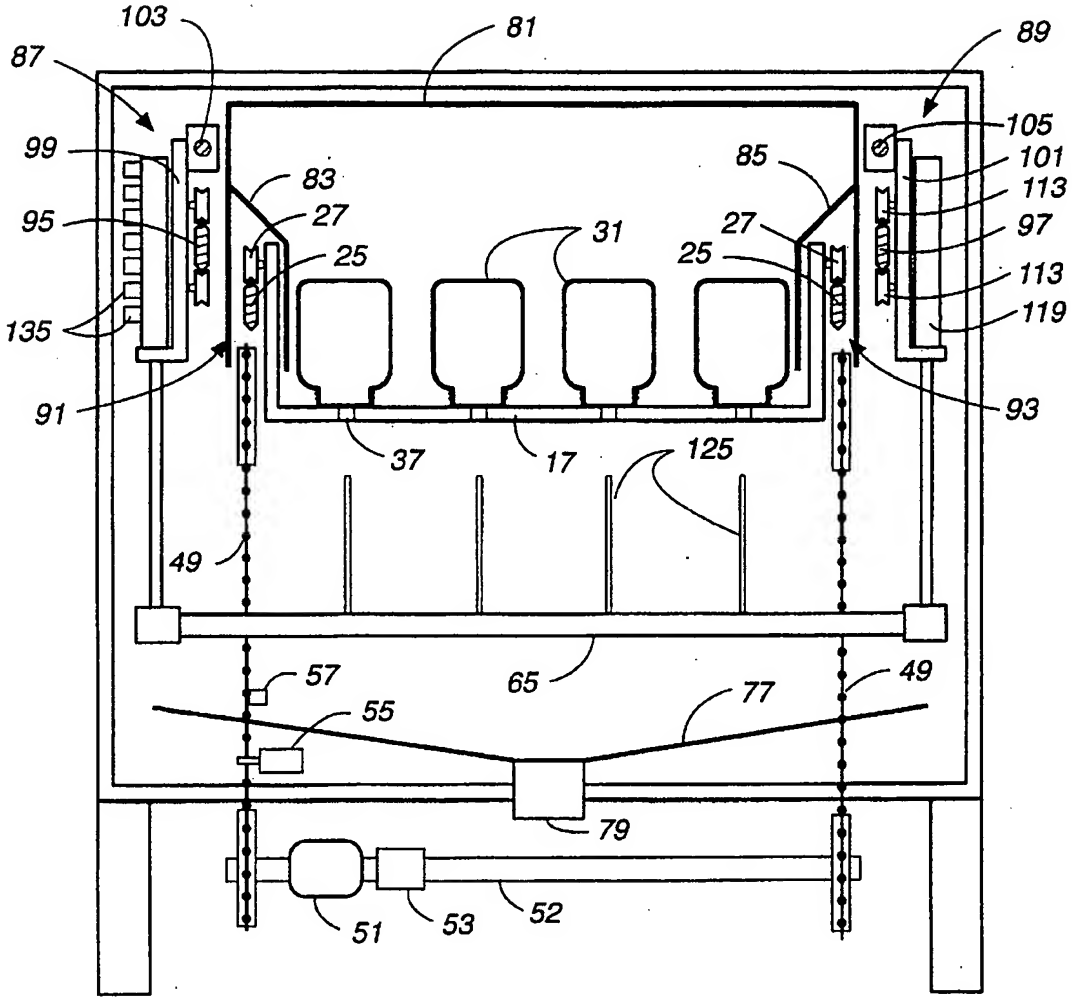

103
81
89
87
105
99
85
101
83
113
95
27
27
97
31
25
25
113
135
119
91
93
37
17
125
49
57
65
77
49
55
79
51
53
52

FIG._5

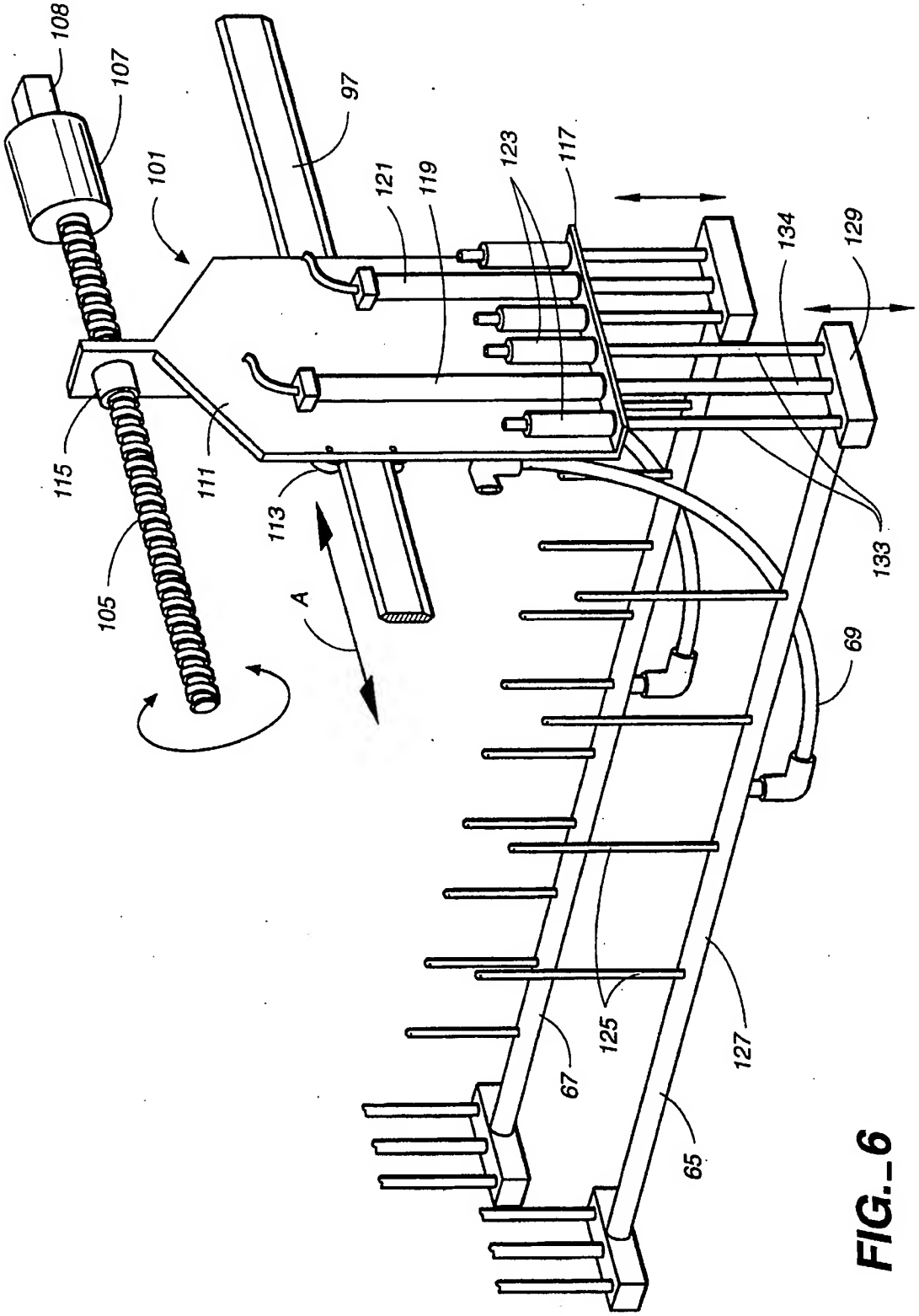

108
107
101
97
121
119
123
117
134
129
115
111
113
105
A
133
69
67
125
127
65

FIG._6

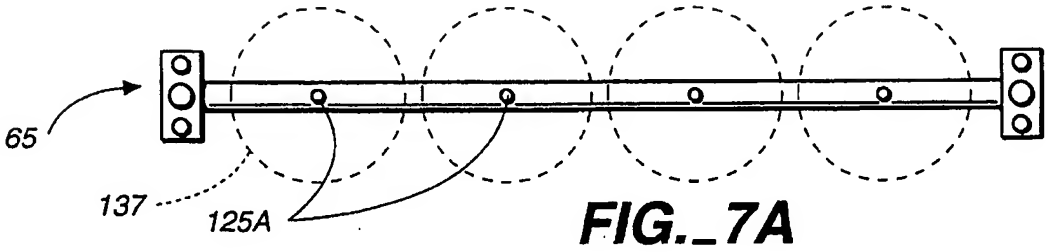


FIG._7A

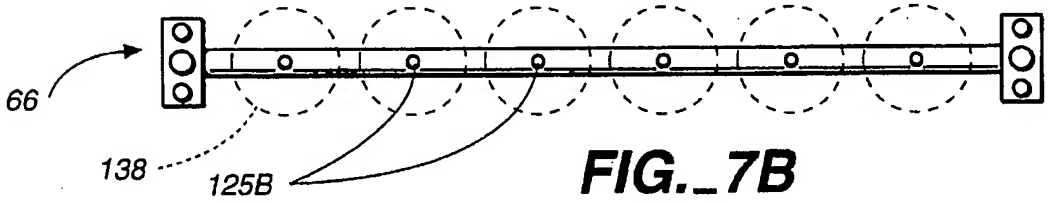


FIG._7B

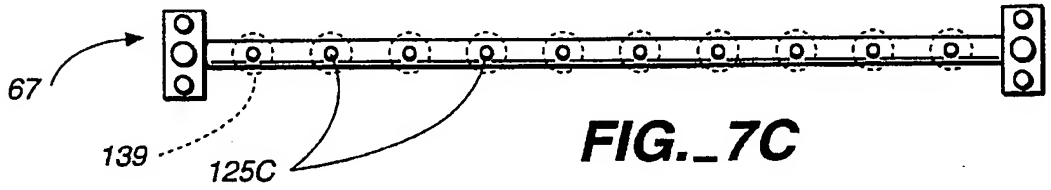


FIG._7C

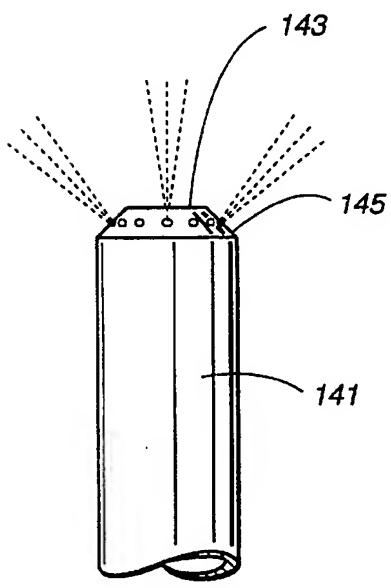


FIG._8A

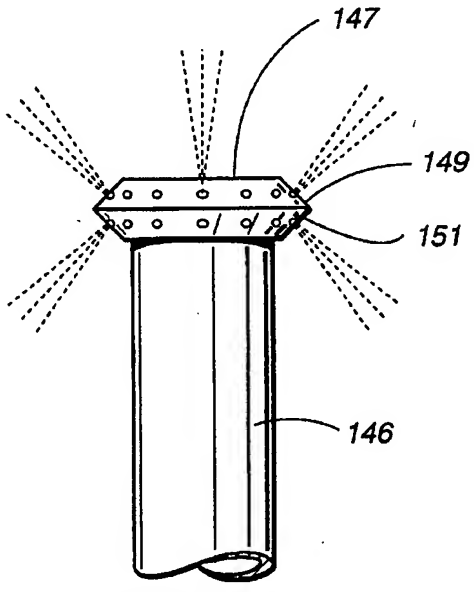


FIG._8B

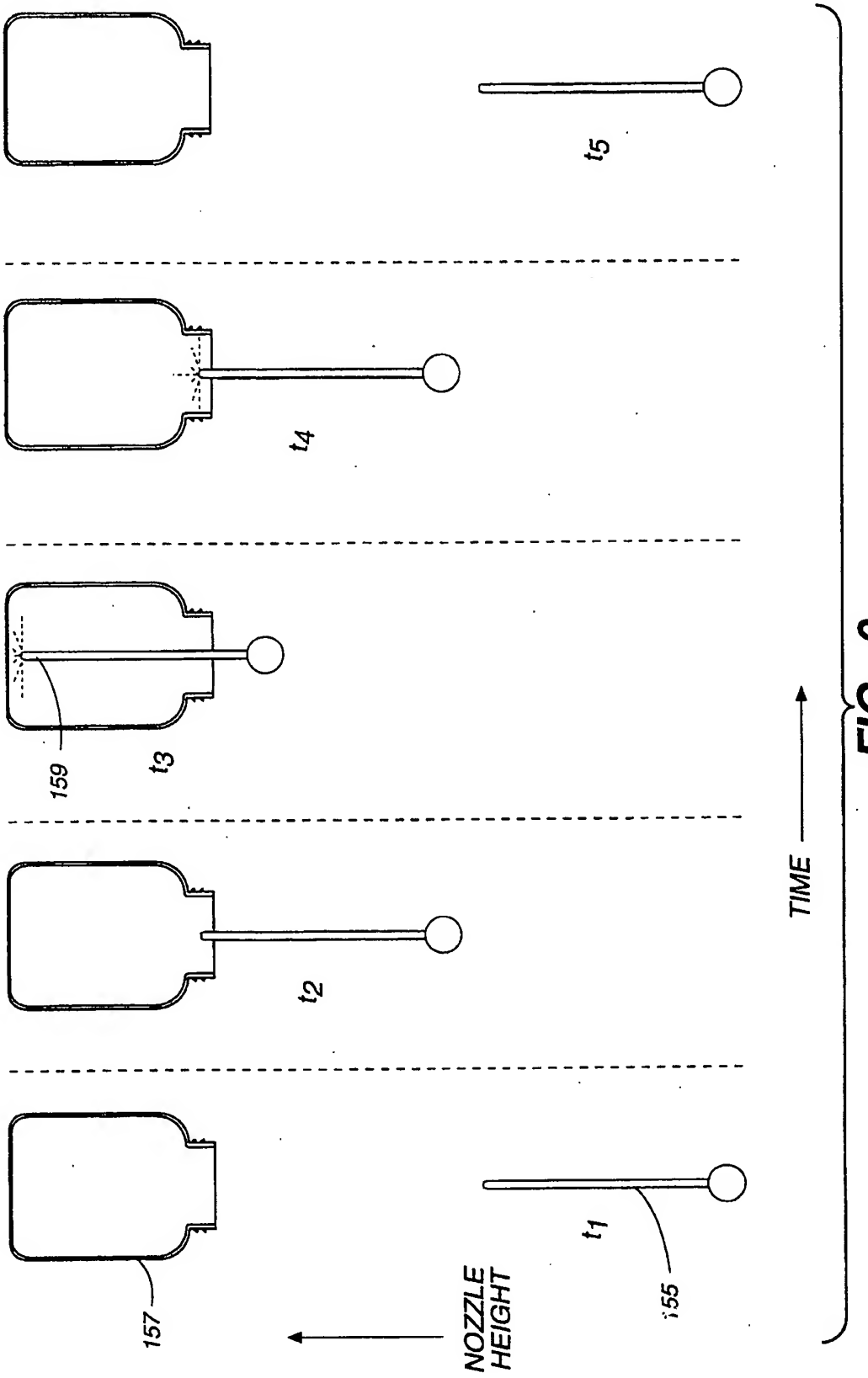


FIG._9

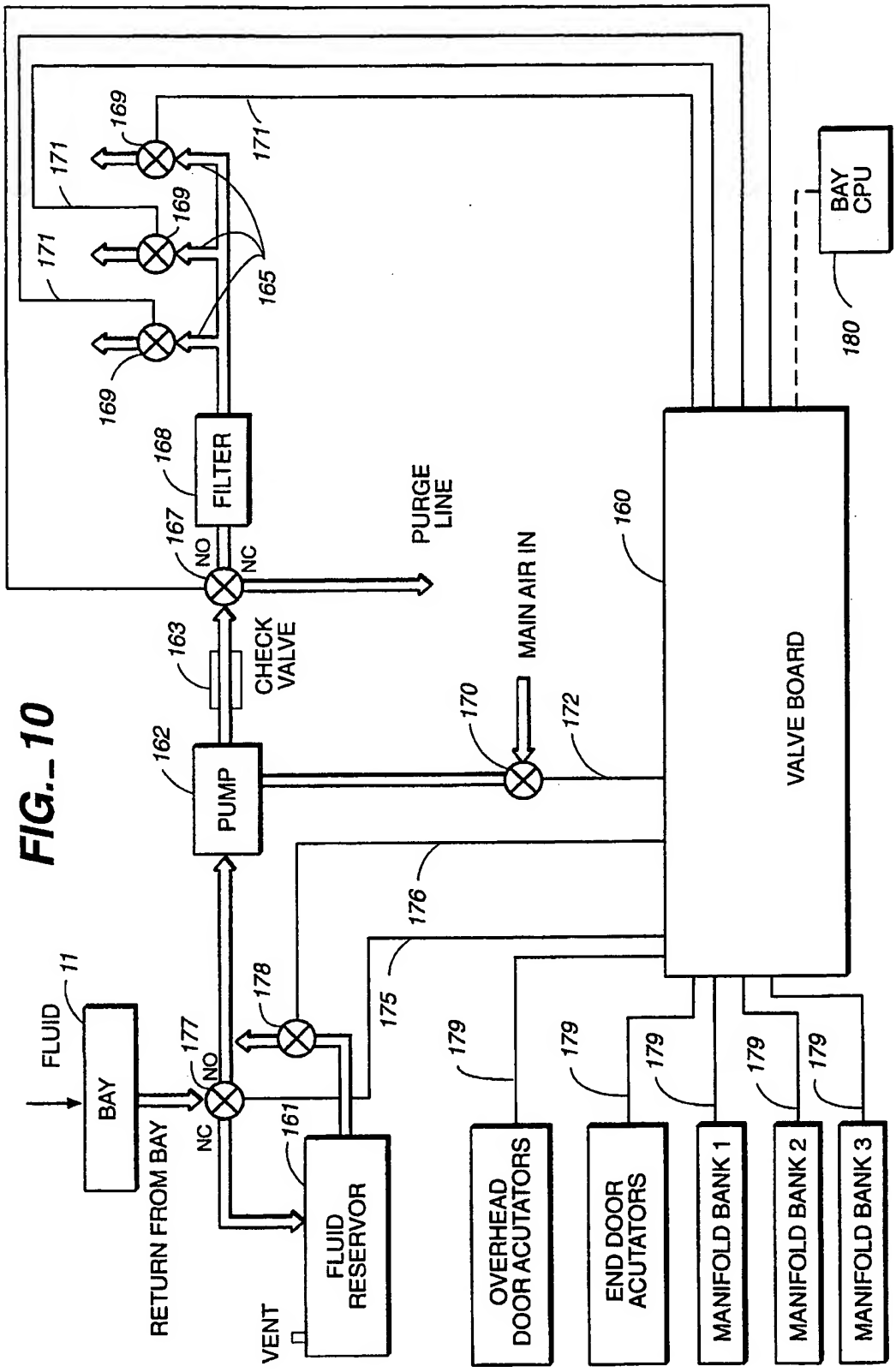

BAY CPU
180
169
171
165
FILTER
168
167
NO
NC
PURGE LINE
MAIN AIR IN
160
VALVE BOARD
CHECK VALVE
163
170
172
PUMP
162
176
175
178
177
FLUID
11
BAY
RETURN FROM BAY
161
FLUID RESERVOR
VENT
179
OVERHEAD DOOR ACUTATORS
END DOOR ACUTATORS
MANIFOLD BANK 1
MANIFOLD BANK 2
MANIFOLD BANK 3

FIG._10

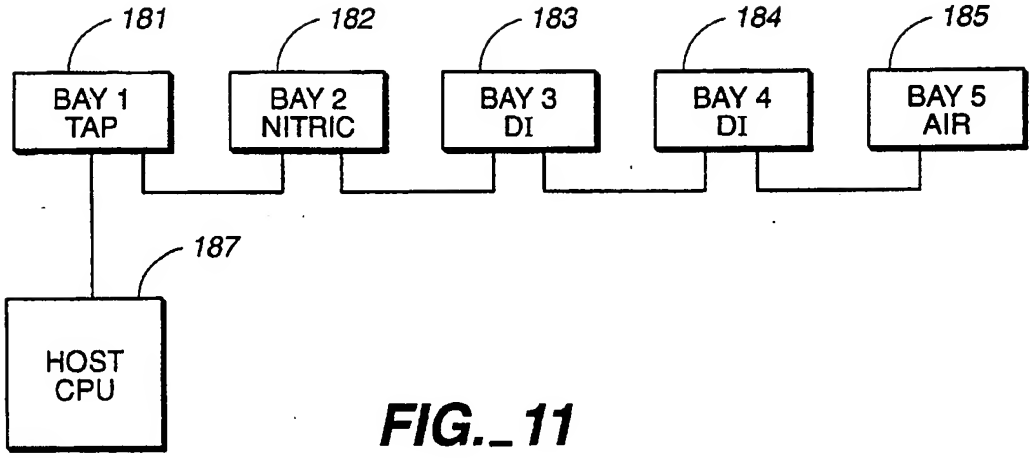

181
182
183
184
185
BAY 1 TAP
BAY 2 NITRIC
BAY 3 DI
BAY 4 DI
BAY 5 AIR
187
HOST CPU

FIG._11

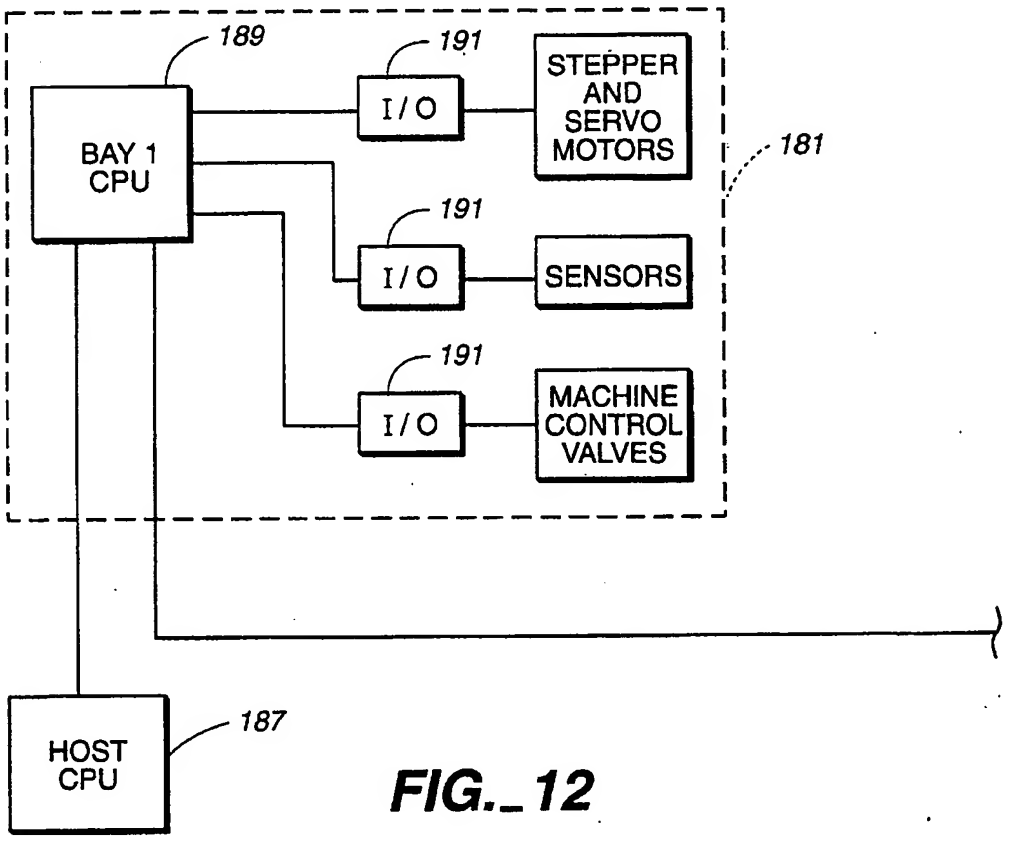

189
191
191
191
BAY 1 CPU
I/O
I/O
I/O
STEPPER AND SERVO MOTORS
SENSORS
MACHINE CONTROL VALVES
181
187
HOST CPU

FIG._12

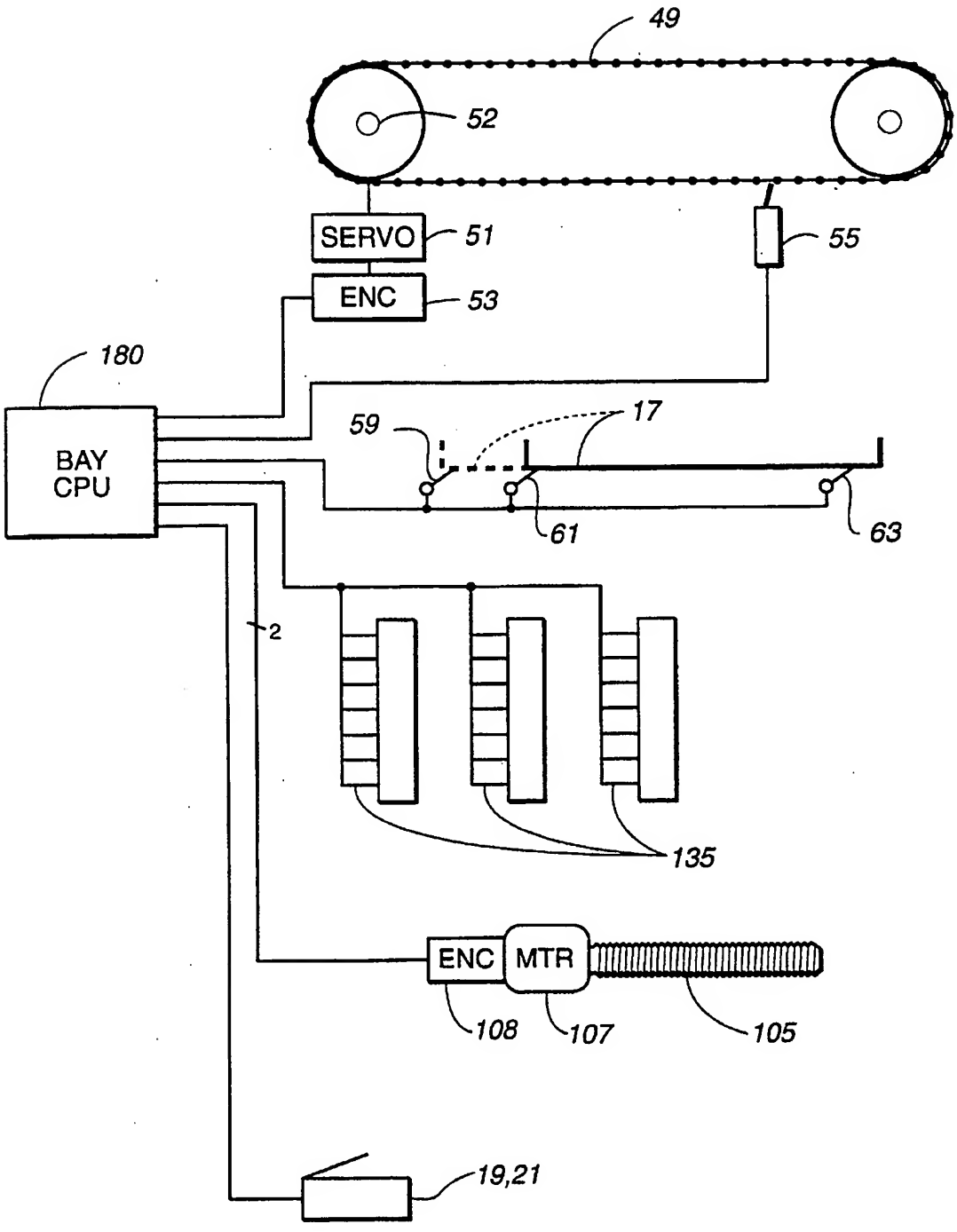

49
52
SERVO
51
55
ENC
53
180
BAY
CPU
59
17
61
63
2
135
ENC
MTR
108
107
105
19,21

FIG._13

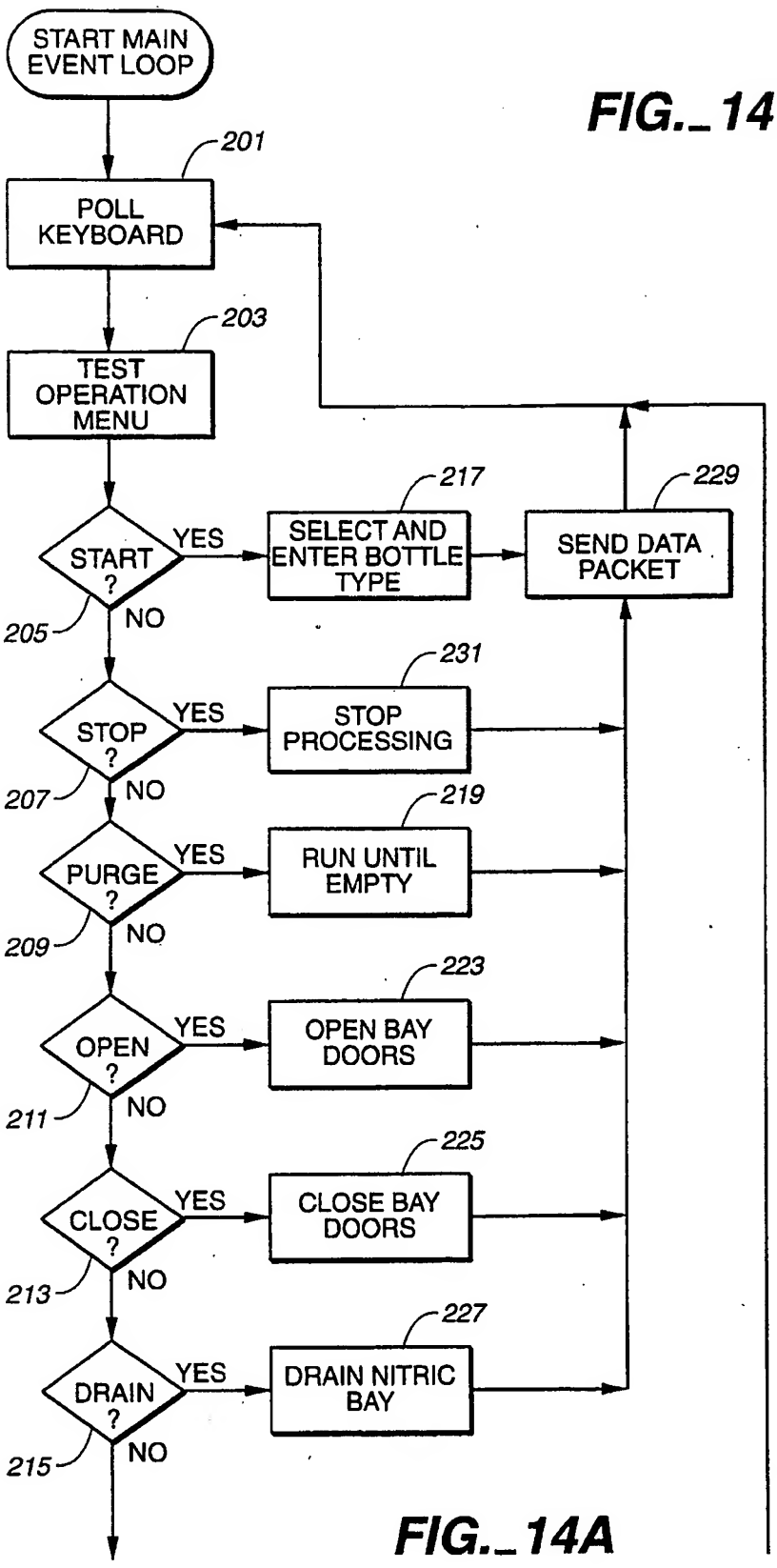


FIG._14A

FIG._14

12/16
FIG 14A
13/16
FIG 14B

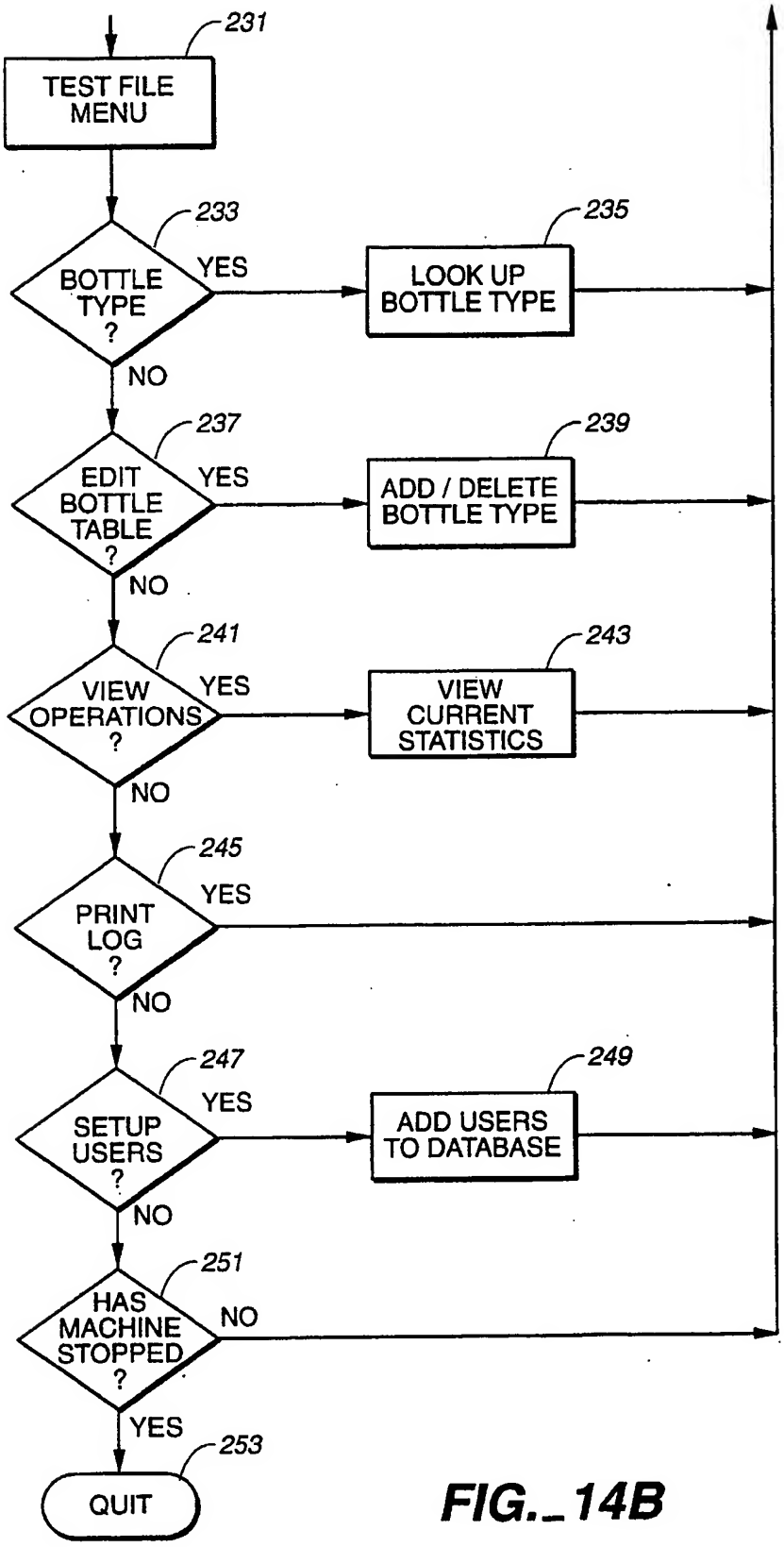

231
TEST FILE MENU
233
BOTTLE TYPE ?
YES
235
LOOK UP BOTTLE TYPE
NO
237
EDIT BOTTLE TABLE ?
YES
239
ADD / DELETE BOTTLE TYPE
NO
241
VIEW OPERATIONS ?
YES
243
VIEW CURRENT STATISTICS
NO
245
PRINT LOG ?
YES
NO
247
SETUP USERS ?
YES
249
ADD USERS TO DATABASE
NO
251
HAS MACHINE STOPPED ?
NO
YES
253
QUIT

FIG._14B

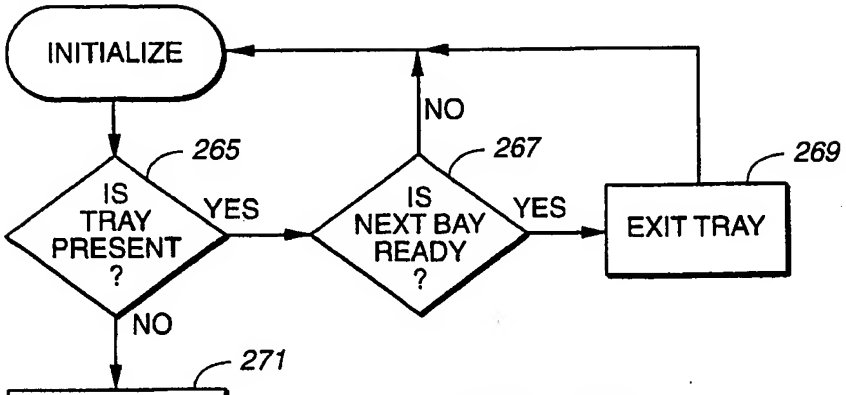
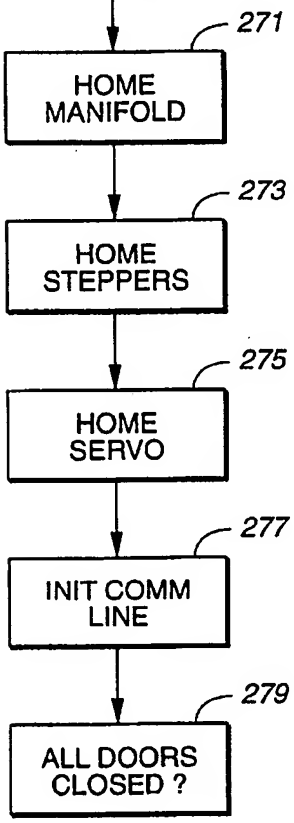

INITIALIZE
265
IS TRAY PRESENT ?
YES
NO
267
IS NEXT BAY READY ?
YES
NO
269
EXIT TRAY

FIG._16


271
HOME MANIFOLD
273
HOME STEPPERS
275
HOME SERVO
277
INIT COMM LINE
279
ALL DOORS CLOSED ?

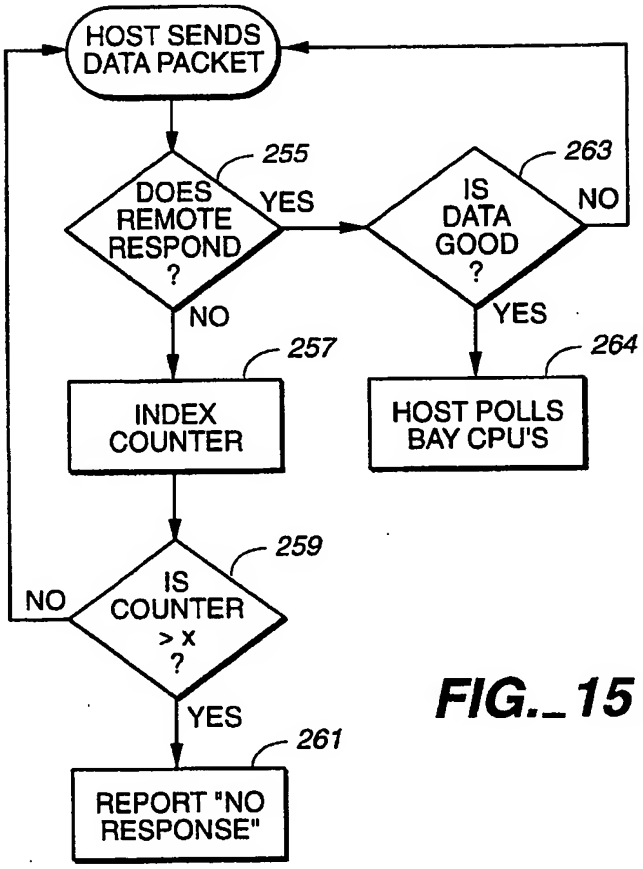

HOST SENDS DATA PACKET
255
DOES REMOTE RESPOND ?
YES
NO
263
IS DATA GOOD ?
NO
YES
257
INDEX COUNTER
264
HOST POLLS BAY CPU'S
259
IS COUNTER > x ?
NO
YES
261
REPORT "NO RESPONSE"

FIG._15

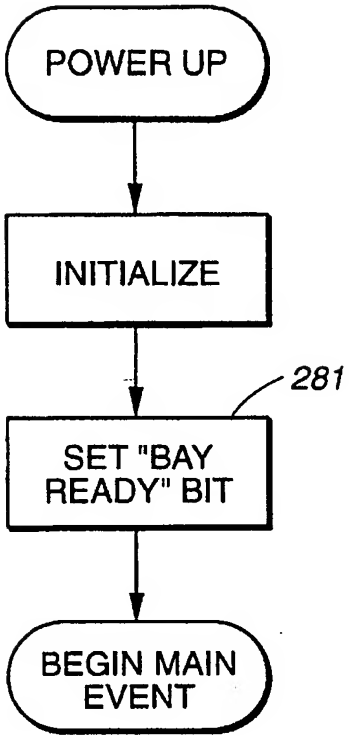

POWER UP
INITIALIZE
281
SET "BAY READY" BIT
BEGIN MAIN EVENT

FIG._17

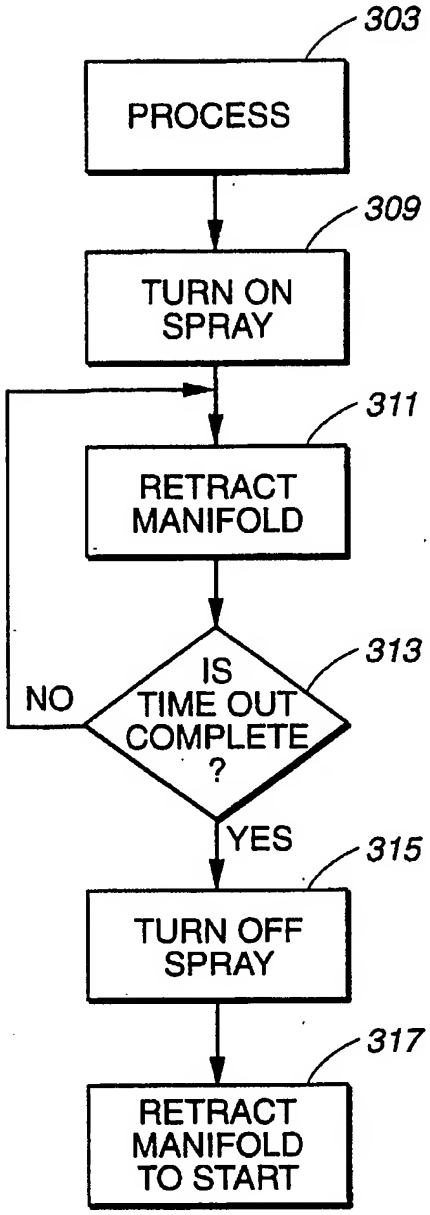

303
PROCESS
309
TURN ON SPRAY
311
RETRACT MANIFOLD
313
IS TIME OUT COMPLETE ?
NO
YES
315
TURN OFF SPRAY
317
RETRACT MANIFOLD TO START

FIG._19

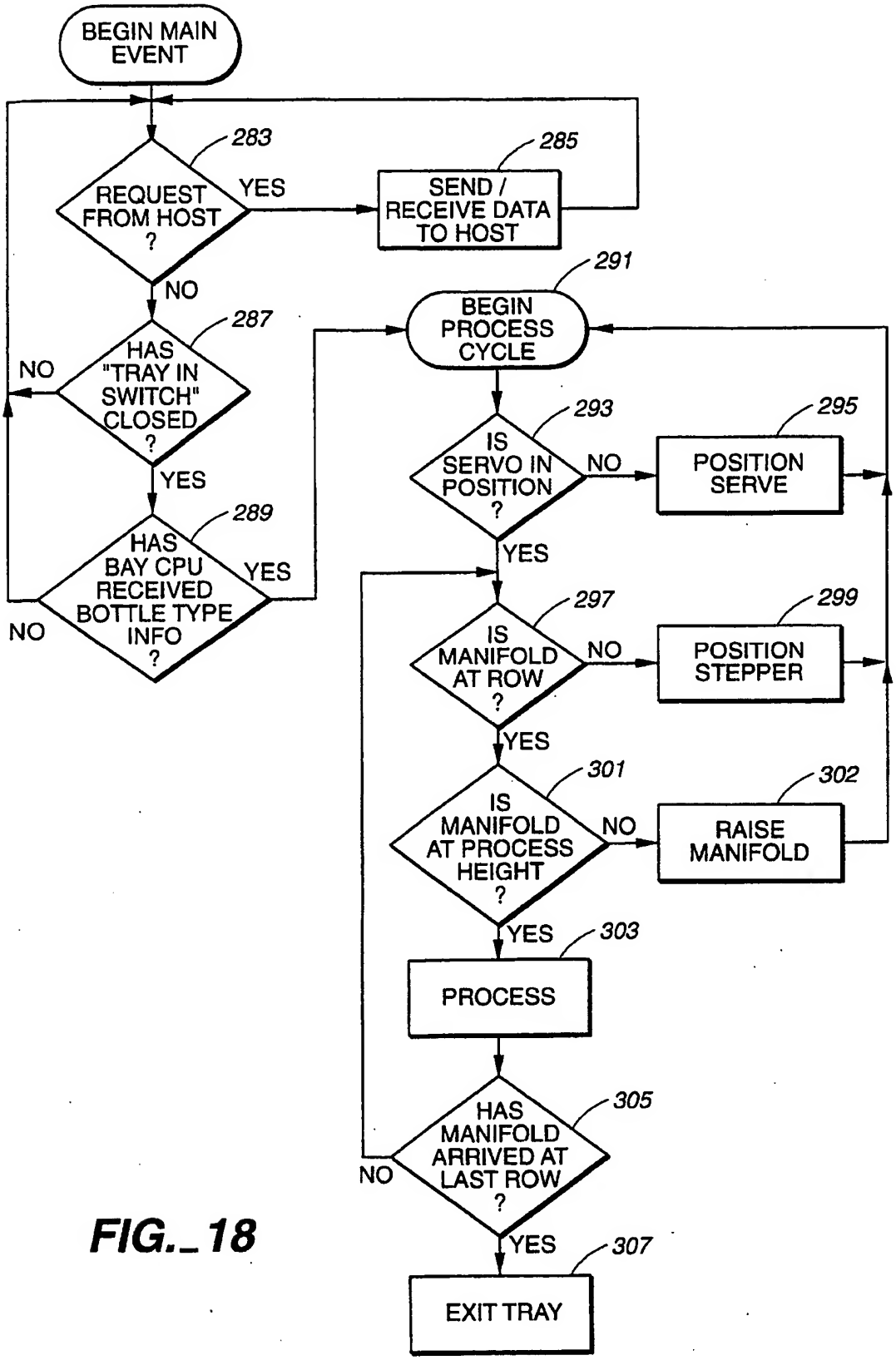

BEGIN MAIN EVENT
283
REQUEST FROM HOST ?
YES
285
SEND / RECEIVE DATA TO HOST
NO
287
HAS "TRAY IN SWITCH" CLOSED ?
NO
YES
289
HAS BAY CPU RECEIVED BOTTLE TYPE INFO ?
YES
NO
291
BEGIN PROCESS CYCLE
293
IS SERVO IN POSITION ?
NO
295
POSITION SERVE
YES
297
IS MANIFOLD AT ROW ?
NO
299
POSITION STEPPER
YES
301
IS MANIFOLD AT PROCESS HEIGHT ?
NO
302
RAISE MANIFOLD
YES
303
PROCESS
305
HAS MANIFOLD ARRIVED AT LAST ROW ?
NO
YES
307
EXIT TRAY

FIG._18

MODULAR APPARATUS AND METHOD FOR CLEANING CONTAINERS

CROSS-REFERENCE TO RELATED APPLICATION

This is a continuation of application Ser. No. 08/027,115 filed Mar. 4, 1993, now U.S. Pat. No. 5,409,545.

BACKGROUND OF THE INVENTION

The present invention relates to an apparatus and method for cleaning containers, and especially glass or plastic sample containers for environmental testing. The invention more particularly relates to an automated and modular cleaning apparatus and method which consistently removes impurities from the interior surfaces of sample containers, and which at the same time greatly increases throughput, that is, the rate at which the sample containers can be processed.

Sample containers used in the environmental industry to perform chemical analysis must be thoroughly cleaned before reuse in order to meet rigorous standards of cleanliness set by the U.S. Environmental Protection Agency (EPA). Even low levels of impurities left on container surfaces after cleaning can invalidate test results performed on a sample, for example, a soil sample, which has been held in the container. To meet strict EPA cleanliness standards, sample containers have heretofore been cleaned manually. Each container is individually hand-scrubbed, usually in a non-phosphate detergent wash with tap water, and then hand-rinsed in a series of required solutions, typically in a rinsing sequence involving a nitric acid solution rinse, a deionized water rinse, and a solvent rinse, such as methylene chloride, for removing oils or grease. Manual washing processes are time intensive and often yield inconsistent results because of inattentive or fatigued workers who do not consistently swipe all the surfaces of every container.

In a known variation of the above-described manual cleaning approach, sample containers, instead of being washed by hand, are washed in a conventional industrial grade dishwasher, such as a Hobart brand washer, before they are manually processed through the required rinses. In a conventional dishwasher, a spinning spray arm beneath the inverted containers projects a wash solution and tap water rinse up into and about the containers to wash both inside and outside container surfaces. A relatively small portion of the spray emitted by the spinning spray arm actually reaches the inside of the container, and that portion that does strike the container's inside surfaces does so at low pressure and in an uncontrolled fashion. As a consequence, cleansing of the critical inside surfaces of the container tends to be incomplete and inconsistent in terms of removing impurities to required levels. A conventional washer is also a wasteful process, requiring large amounts of fluid to be emitted by the spin arm compared to the amount of fluid actually contacting the container surfaces.

U.S. Pat. No. 4,667,690 to Hartnig discloses yet another approach to washing containers, in this instance washing bottles prior to being filled by a filling machine with a liquid content such as, for example, a carbonated drink. In Hartnig, the bottles are processed on a continuous straight line conveyor system, rather than in a batch process. The rinsing cycle involves conveying the bottles in an inverted position over nozzles which are mounted on a rotating platform that is synchronized with the bottles. While this continuous process provides a more direct spray into the mouth of the inverted bottle, the spray still only reaches the inside surfaces of the bottle from a source outside the container. Thus, in Hartnig the spray is likely to reach only a portion of the interior surfaces of the container and the portions of the surfaces it does reach is reached at different angles and thus with varying degrees of effective scouring force. A cascade of fluid must be relied upon to clean a portion of the surfaces, and particularly shoulder surfaces near the neck of the container. Such limitations become particularly crucial when the cleanliness of the bottles must meet exacting EPA or similar standards.

The present invention is intended to overcome the disadvantages of existing approaches to cleansing sample containers and other types of containers. The invention improves over existing manual processes by greatly increasing throughput and providing consistent results. The invention also improves on the efficacy of existing automated and semi-automated approaches, whether involving batch or continuous processing, by providing a more direct, even, and consistent high pressure spray or fluid stream to the interior container surfaces to impart a more complete and thorough scouring action to these surfaces. The invention is uniquely adapted to handling a variety of container types and sizes, such as Boston round jars, amber wide mouth jars, round packers, cream jars, straight sided (paragon) jars, modern round (versus cylindrical round) plastic containers, and vials, and conserves fluids by efficiently directing sprays to surfaces to be cleaned in a focused manner. Finally, the invention provides for modular units that can flexibly be cascaded together to provide different cleaning, rinse and drying functions.

SUMMARY OF THE INVENTION

Briefly, the apparatus and method of the invention involves a modular apparatus and method for cleaning containers comprised of individual stand alone cleaning bays that can be interchangeably cascaded together to provide different cleaning and rinsing functions using different cleaning and rinsing solutions. For example, a modular apparatus in accordance with the invention can provide for a sequence of five cleaning bays to provide five required washes and rinses under EPA regulations as follows: a first bay can provide a detergent wash followed by a bay for a recirculated nitric acid solution rinse. Third, fourth and fifth bays in turn can provide de-ionized water rinses, a possible solvent rinse, and possibly an air dry function.

In accordance with the invention, at least two modular cleaning bays are interchangeably cascaded together with a defined first bay and end bay. Transporting means are provided for transporting a set of inverted containers along a defined container support plane and in a predetermined space relationship successfully into each modular cleaning bay from the first bay to the end bay. In each bay the containers are cleaned by a fluid stream supply means which includes at least one nozzle bank disposed below the container support plane. The nozzle bank in each bay has a set of elongated nozzle elements arranged in correspondence with the space relationship of the set of inverted containers transported into the bay. Means are provided for registering the nozzle elements with the set of containers transported into the bay and, once the nozzle elements are registered with the containers, for cycling the nozzle bank in a forward and return movement that causes the set of nozzle elements to traverse through the mouth ends of the set of containers. Fluid control means associated with each bay activates the bay's fluid supply means such that a fluid stream of a

selected fluid is emitted from the bay's set of nozzle elements when the nozzle elements traverse through the set of containers to thereby clean the inside surfaces of the containers.

Each of the cascaded cleaning bays of the apparatus of the invention is fluidly isolated from the adjacent cleaning bay to prevent cross-contamination of fluids. This is preferably accomplished by providing each of the cleaning bays with an infeed and outfeed door which operatively close during the process cycles of each cleaning bay.

It is contemplated that sets of containers of a given size will be loaded onto container support trays which will be carried from one cascaded bay to the next on support rails. In its preferred embodiment, all of the cascaded cleaning bays will have at least two independently operable nozzle banks with each nozzle bank being adapted to clean different size containers. In this manner, support trays of containers of a particular size and shape can be processed by operatively selecting the nozzle bank within the cleaning bay suitable to that particular size. When support trays are subsequently loaded with container sizes and shapes different from that of a previous run, a different nozzle bank can be operatively selected.

Each of the cascaded cleaning bays can be operated under computer control wherein container support trays manually fed into the first bay are automatically sequenced through and processed by each of the successive bays. The computer control can establish bottle type to be cleaned, sequences of trays through the bays, and can initiate and control the process cycle in each bay wherein the bay's selected nozzle bank is cycled through the rows of inverted containers supported in the container support tray.

It is therefore seen that a primary object of the invention is to provide for an automated apparatus and method for cleaning containers to exacting standards, and particularly the interior surfaces of sample containers that must meet EPA standards. It is a further object of the invention to provide an apparatus and method that increases through-put while achieving consistent results, and an apparatus and method that is flexible and minimizes waste. Other objects of the invention will be apparent from the following specification and claims.

DESCRIPTION OF THE DRAWINGS

FIG. **1** is a perspective view of a cleaning bay in accordance with the invention showing a tray of containers being loaded into the bay.

FIG. **2** is a perspective view of a tray and tray insert for supporting containers in an inverted position within the cleaning bay.

FIGS. **3A–3F** show profiles of three general types of sample containers loaded onto different appropriately sized tray inserts shown both in a partial, cross-sectional front elevational view (FIGS. **3A–3C**), and in fragmentary top plan view (FIGS. **3D–3F**).

FIG. **4** is a diagrammatic view in side elevation of the interior of a cleaning bay showing the relative positioning of the container support tray and nozzle banks within the bay and the x-axis motion of the nozzle banks beneath the tray.

FIG. **5** is a diagrammatic endwise elevational view of the interior of the cleaning bay additionally showing the roller assembly and air cylinders which carry and operate the nozzle banks, and the tray overhead splash guard.

FIG. **6** is a perspective view of a nozzle bank and nozzle bank roller assembly and drive mechanisms.

FIGS. **7A–7C** are top plan views of three nozzle banks showing different nozzle element spacings relative to different diameter containers shown in phantom lines.

FIGS. **8A** and **8B** are fragmentary side elevational views of a nozzle element of the nozzle banks showing two alternative designs of the nozzle tip.

FIG. **9** is a diagrammatic representation of the process cycle of the nozzle bank wherein a nozzle element of the nozzle bank traverses through the open mouth end of an inverted container.

FIG. **10** is a generalized pneumatic and hydraulic circuit diagram generally illustrating the pneumatic and hydraulic controls of the cleaning bay.

FIG. **11** is a block diagram showing five cleaning bays cascaded together under the supervision of a host central processing unit (CPU).

FIG. **12** is a block diagram illustrating the various input/output (I/O) requirements of each bay CPU.

FIG. **13** is a pictorial illustration of the various sensor inputs to the bay CPU for each cleaning bay.

FIGS. **14**, **14A** and **14B** show a flow chart illustrating the operator control features of the host CPU.

FIG. **15** is a flow chart illustrating the procedure by which the host CPU communicates with the individual bay CPUs.

FIG. **16** is a flow chart illustrating the basic initialization function of the bay CPU.

FIG. **17** is a flow chart that illustrates the basic power up sequence of the bay CPUs.

FIG. **18** is a flow chart illustrating the basic operating sequences of each bay CPU in controlling the positioning and movement of the tray and nozzle bank by which the nozzle elements of the nozzle bank are cycled through the containers held by the tray.

FIG. **19** is a flow chart illustrating the process by which the fluid stream from the nozzle elements is turned on and off.

DETAILED DESCRIPTION OF THE ILLUSTRATED EMBODIMENT

The illustrated embodiment of the invention provides for a batch process in which a tray of inverted containers is processed through a series of separate cleaning bays, each of which performs a designated step in an overall cleaning process, including a washing step, various rinsing steps, and even a drying step. In each of the cleaning bays, substantially the entirety of the interior surfaces of the containers supported within the cleaning bays are subjected to a direct stream of fluid under high pressure during a process cycle which is hereinafter described in greater detail. Under computer control, trays of containers are sequentially hand-fed from a suitable loading platform into the first cleaning bay, automatically processed through each of the subsequent cascaded cleaning bays, and exited from the final bay. The apparatus, as will be seen, can be readily programmed to process different container sizes and shapes.

Referring now to the drawings, FIGS. **1** and **4** show a cleaning bay **11** having an infeed end **13** and an opposed outfeed end **15** for, respectively, receiving a tray of containers **17** into the cleaning bay and, after the containers have been processed, exiting the tray from the bay. Pneumatically actuated infeed door **19** and outfeed door **21** provide for closure of the infeed and outfeed ends of the cleaning bay when the container tray is resident within the bay. The top

wall 23 of the cleaning bay can also suitably include an hydraulically actuated top door to permit convenient access to the cleaning bay for inspection and maintenance.

Means for supporting an array of containers of different sizes in an inverted position within the cleaning bay are illustrated in FIGS. 1-3. The container supporting means includes horizontal support rails 25 extending through the cleaning bay for movably supporting the container support tray 17 on V-rollers 27 located at the four corners of the tray. As best illustrated in FIG. 2, the support tray includes a tray insert 29 that holds an array of containers 31 in an upright, inverted position at the bottom of the tray. As best seen in FIGS. 2 and 3, the tray insert has spacer elements in the form of upright flange pairs 33 arranged in columns on elongated channel elements 35 having nozzle access holes 37 interspersed between the flange pairs. Adjacent flange pairs provide four upright contact edges, such as edges 39 in FIG. 3D, for holding a container of a given diameter over the nozzle access hole situated between the flange pairs. The known, predetermined spaced relationship of the insert's nozzle element access holes is used to position the nozzle banks as hereinafter described.

As shown in FIG. 3, a variety of different inserts can be provided to accommodate different container sizes and shapes and to allow for different spacings between containers. For example, in FIGS. 3A and 3D, the upright flange pairs 33 are spaced to accommodate a relatively large diameter bottle 41, whereas the flange pairs of FIGS. 3B and 3E accommodate an intermediate diameter jar 43. The flange pairs illustrated in FIGS. 3C and 3F, on the other hand, have relatively tightly spaced flange pairs to accommodate small diameter vials 45. In each case, the mouths 42, 44, 46 of the containers are positioned over the precisely located nozzle access holes distributed along the support channel of the insert.

It is noted that each access hole in the insert for holding narrow mouth containers as shown in FIGS. 3A and 3D preferably has a nylon bushing 47 for seating the mouth of the container against the support channel 35. The use of such bushings will minimize the tendency of the lips of narrow mouth glass bottles to chip during processing. It is also noted that, while the inserts for simplicity could provide for the same spacing between containers for all container sizes and shapes, the inserts will preferably adjust the spacing of the containers in accordance with the container diameter so as to maximize the packing of the containers within the tray and therefore maximizing the throughput of containers. As hereinafter described, variations in the spacings between containers will require correspondingly varied spacing for the nozzle elements used to process the containers.

It is further noted that the tray and tray inserts, as well as other parts in the cleaning bay directly exposed to the fluid environment, should preferably be fabricated of corrosion resistent stainless steel.

FIGS. 4 and 5 illustrate the means by which containers supported in a container support tray are processed through the cleaning bay. Such means includes a means for transporting the container's support tray 17 into and subsequently out of the cleaning bay through the cleaning bay's infeed and outfeed ends 13, 15, and for precisely positioning the tray in the cleaning bay where the tray holds the containers in a fixed horizontal plane for processing. The illustrated transporting means includes dual continuous loop drive chains 49, each of which travels along an upper horizontal path 50 proximate and parallel to the tray support rails 25, and each of which has a suitable tray pick-up dog (not shown) which picks up a tray of containers fed into the infeed end 13 of the cleaning bay 11 from a suitable loading platform or previous bay and which subsequently release the tray when it is exited through the outfeed end 15 of the bay. The dual drive chains are synchronously driven by drive shaft 52 and servo motor 51. An encoder 53 associated with the servo motor determines and controls the precise position of the chain, and therefore the precise position of the container support tray 17, in reference to a home position established by home position sensor 55, suitably a photodetector, which detects a flag 57 on the chain as it passes by the home position sensor. Contact switches 59, 61, 63 are additionally located within the path of travel of the tray to establish that a tray has been fed into the cleaning bay and has actually arrived at the position dictated by the sensory feedback of the encoder 53 and home position sensor 55. The first contact switch 59 is positioned proximate the infeed end 13 of the bay to signal a tray is arriving, and two additional position contact switches 61, 63 are located such that they both simultaneously contact the tray when the tray has arrived at its approximate processing position. The position contact switches provide a positive indication that the tray has actually arrived under the control of the servo motor and encoder sensory feedback. These switches can thus signal any mechanical failure that prevents the tray from being properly positioned.

FIG. 4 also pictorially depicts a group independently operable nozzle banks 65, 66, 67 and their associated fluid supply lines 69, which are generally positioned below the horizontal plane of the container tray 17 and which are movable along an x-axis (represented by arrow denoted "A") from one end of the container tray to the other (as depicted by the phantom line representation of the nozzle banks). The x-axis movement of the nozzle banks permits a selected nozzle bank to be registered with the open mouth ends of the containers held in the tray, and more specifically with the precisely located nozzle access holes 37 in the tray insert over which the containers are supported. The nozzle banks, with their associated nozzle elements 71, 72, 73 and fluid supply lines, provide means for supplying a stream of fluid to the cleaning bay, and particularly to the inside of the containers when the nozzle banks are processed through the containers in a z-axis motion as hereinafter described. The fluids supplied to the nozzle banks are suitably supplied from a remote fluid reservoir (see FIG. 10) and may consist of a variety of fluids, including tap water, a nitric acid solution, de-ionized water, or air from a compressor for drying.

With reference to FIG. 4, it is noted that one or more additional spray elements (such as spray element 75) can suitably be provided overhead the container tray to provide an additional source of fluid spray to rinse the exterior surfaces of the containers 31. While it is contemplated that the interior surfaces of the containers will repetitively be processed through a series of cascaded cleaning bays using different solutions, an external spray need only be provided in selected bays as required to meet aesthetic cleanliness standards for the containers' non-critical exterior surfaces.

As best seen in FIGS. 4 and 5, fluids supplied through the bay's nozzle elements 71, 72, 73 and external spray element 75 fall into a catch basin 77 at the bottom of the cleaning bay which directs the fluids to a central drain 79 through which the fluids can be disposed of, recovered, and/or recycled. Splash guards are suitably provided within the cleaning bay to shield the cleaning bay's various operative parts from the fluids emitted by the bay's nozzle and external spray elements and for directing the fluids into the bay's catch basin.

As illustrated in FIG. 5, splash guards include a tray overhead splash guard 81 having opposed downwardly extending channel portions 83, 85 which shield outboard regions 87, 89 housing the moving parts of the nozzle banks, and which also shield inboard regions 91, 93 containing the support rails 25 for the tray and the upper horizontal path 50 of the tray's drive chain. It is further contemplated that vertical spray guards (not shown) will be disposed in front of the vertical portions of the chain. The various spray guards will have an eave effect which cause the splashing fluids within the bay to run down toward the catch basin for removal through the drain. Because there is no vigorous spray action outside of the spray emitted within the containers and the external spray emitted immediately below the tray overhead splash guard, the cleaning bay is able to contain and direct the fluids without the need for special sealing.

The structure and deployment of the nozzle banks and the means for registering the nozzle elements of the nozzle bank with the inverted containers residing in the container tray are best illustrated in FIGS. 5 and 6. Before described these structures, it is preliminarily noted that FIG. 6 illustrates only the first and last one of the nozzle banks 65, 66, 67 diagrammatically illustrated in FIG. 4; the intermediate nozzle bank 66 has been omitted for clarity. It is understood that the number of nozzle banks will depend on the variety of container spacings that the apparatus is designed to accommodate.

The nozzle banks 65, 67 are carried on nozzle guide rails 95, 97 by means of roller assemblies 99, 101 that are driven along the guide rails by means of lead screws 103, 105 synchronously driven by stepper motors 107 operatively connected to the ends of each lead screw. Each roller assembly consists of a vertical carriage plate 111 having two V-roller pairs 113 and a lead screw drive collar member 115 secured to the inside of the plate, and a horizontal cylinder support ledge 117 extending from the plate's outside bottom edge. Each of the independently operable nozzle banks are retractably coupled to the carriage plate of each roller assembly by means of pneumatic cylinders and linear bearing blocks, such as the pneumatic cylinders 119, 121 and bearing blocks 123 mounted to the top of the support ledge 117 of the carriage plate as best shown in FIG. 6.

Each nozzle bank, for example nozzle bank 65, more specifically has a series of elongated nozzle elements 125 extending upwardly from a horizontal manifold 127 which receives a fluid supply through fluid supply lines 69. At each of its ends the manifold is connected via junction blocks 129 to the retractable plunger elements 134 of the pneumatic cylinders 119 and to the two straddling guide rods 133 of the associated bearing blocks 123. As the pneumatic cylinders 119, 121 raise and lower a nozzle bank as further described below, the bearing blocks will act to keep the nozzle bank aligned with the pneumatic cylinder to prevent binding of the plunger within the cylinder.

It can be seen that there are two critical motions of the nozzle banks. First is the x-axis motion in which the nozzle elements of a selected nozzle bank can be registered with the open mouth ends of the containers supported in a resident tray, and a z-axis motion which involves a means for generating a process cycle in which the nozzle elements are caused to traverse through the mouth end of the containers registered therewith. In other words, the z-axis motion of the nozzle banks cause the selected nozzle banks to cycle in a forward and return motion as depicted by the vertical arrows in FIG. 6 such that the tip of the nozzle elements travel through the container for a dwell time during which a direct, high pressure stream of fluid sweeps the interior surfaces of the containers. As shown in FIG. 5, Hall Effect sensors 135 are provided along one of the pneumatic cylinder pairs associated with each nozzle bank to provide a means of detecting the forward advance of the nozzle bank so that the nozzle bank's direction of travel can be reversed at a height programmed to correspond with the particular bottle size being processed. The Hall Effect sensors, which require the pneumatic cylinders to be adapted to provide a detectable magnetic field, provide a relatively easily implemented binary feedback system for regulating the nozzle elements' direction of travel. It shall be appreciated that other feedback systems could be used, including linear feedback systems that would permit greater control over the nozzle's travel and dwell time characteristics. For example, it might be desirable to have the nozzle elements dwell for a longer period of time at a certain region of the container where greater concentrations of impurities are normally found.

In FIG. 6 it can been seen that different nozzle banks are provided with nozzle elements of different lengths. Each of the nozzle banks will be selected for processing a different range of container sizes. With height indexing through feedback from the Hall Effect sensors 135, the nozzle banks will be able to accommodate a wide range of container sizes.

The provision for separate, independently operable nozzle banks also enhances the throughput capabilities of the apparatus. FIGS. 7A–7C show three nozzle banks 65, 66, 67 (corresponding to the nozzle banks 65, 66, 67 in FIG. 4) having nozzle elements 125A, 125B, 125C of three different spacings which accommodate containers 137, 138, 139 of three different diameters so as to optimize the packing density of the containers. As shown in FIG. 7A, large diameter containers 137 are processed by a nozzle bank having nozzle elements 125A of a relatively wide spacing whereas FIG. 7C shows a relatively narrow spacing for the nozzle elements 125C for processing relatively small diameter containers 139.

FIGS. 8A and 8C show yet another way in which the nozzle banks can be configured to meet different processing requirements: that is, by providing different nozzle tip designs for providing different spray patterns from the nozzle elements. For example, FIG. 8A shows a nozzle tip 141 having two spray emitting surfaces, a first emitting surface 143 which is a top surface for projecting a forward spray, and a second spray emitting surface 145 which is a forward facing angled surface for projecting a sideward spray. The nozzle tip 146 shown in FIG. 8B on the other hand has, in addition to a first top spray emitting surface 147, both a second spray emitter surface 149 which is a forward facing angled surface, and a third spray emitting surface 151 which is a rearward facing angled surface for projecting a rearward stream of fluid. The nozzle tip design of FIG. 8B would be particularly useful for narrow mouth containers having interior horizontal shoulder surfaces surrounding the mouth of the inverted container.

Thus, it can be appreciated that a wide variety of nozzle bank configurations can be provided to meet a wide variety of processing requirements involving different container sizes, shapes and materials. Processing requirements can be met by providing different selectable and independently operable nozzle banks as above-described, and by providing for exchangeable nozzle elements within a given nozzle bank. Regardless of the nozzle bank selected or the nozzle configuration used, the processing cycle will be the same for each nozzle bank.

The processing cycle for a nozzle bank is illustrated in FIG. 9 wherein the movement of one nozzle element 155 of

a nozzle bank relative to an inverted container **157** is shown at five different points in the cycle occurring at times t_1, t_2, t_3, t_4, and t_5. The beginning and end of the cycle occur at times t_1 and t_5 where the nozzle bank is fully retracted. At t_3 the tip **159** of the nozzle has advanced to its full desired height within the container as signalled by the Hall Effect sensors **135** on the pneumatic cylinder associated with the nozzle bank. With feedback from a selected Hall Effect sensor, the nozzle element is caused to reverse direction at t_3 so that it retracts to its starting position shown at t_5. Also, at t_3, fluid control means, operated under the control of the bay central processing unit (CPU) hereinafter described, initiates a fluid stream which remains on while the nozzle element retracts to the position shown at t_4, at which time the fluid stream is turned off. Thus, the fluid stream will sweep the interior surfaces of the container for the container's entire length and will only be activated inside of the container thereby conserving fluid and confining the reach of the fluids within the bay. Other sequences of turning the fluid stream on and off are possible, for example, initiating the fluid stream at t_2 when the tip of the nozzle element first enters the mouth of the container so as to sweep the container sides in both directions; however, initiating the stream at the height of the nozzle bank's travel minimizes fluid consumption and is a sequence readily implemented by a time-out circuit triggered by the Hall Effect sensor feedback.

The above-described process cycle is generated for a nozzle bank selected in accordance with the container size and type to be processed. It is repeated as the selected nozzle bank is moved into registration with each row of containers in the tray from the first row to the last row (see the diagrammatic representation of the nozzle banks in FIG. 4). The means for registering the nozzle elements of the nozzle bank with each row of containers can more specifically be described in reference to FIGS. **4–6**, wherein it is seen that synchronous stepper motors **107** rotate the lead screws **103, 105** to precisely advance the nozzle banks carried on the roller assemblies **99** from a know "home" position. A lead screw encoder **108** is operatively connected to at least one of the lead screws to provide sensory feedback that indicates that the nozzle banks have actually moved to where they are supposed to be. If problems arise with any of the lead screw couplings, the effect on the positioning of the nozzle banks will be signaled by the encoder.

It should be noted that the home position of the nozzle banks would logically be at one end of the resident container tray or the other such that the nozzle banks move from a first row of containers to an end row. Preferably, the nozzle banks will successively home to both ends of the tray such that the nozzle bank first processes a tray of containers from a front row of containers to a back row and then processes the next tray of containers from a back row to a front row. Providing two home positions at either end of the tray eliminates the need for the nozzle bank to travel back the length of the container before the next tray can arrive, with the result that overall processing speed is increased.

FIG. **10** generally illustrates suitable hydraulic and pneumatic circuits for each cleaning bay which, under the control of the bay CPU **180**, conduct fluids through the system, which operate the required control values—some of which are suitably located on a valve board **160** mounted to the bay—and which actuate the various air cylinders for closing bay doors and raising the nozzle banks. The fluids for the nozzle banks are supplied under pressure by pump **162** from a remote fluid reservoir **161** through a circuit which includes check valve **163**, filter **168**, fluid supply lines **165**, and a three-way valve **167** used to purge the lines. The circuit also includes fluid control means for turning the fluid stream from the nozzle elements of the nozzle bank on and off. This fluid control means is in the form of two-way nozzle bank valves **169** which are actuated through control lines **171**. Similar control lines **172, 175,176** actuate valves **170, 177, 178**. Fluids captured in the bay's catch basin can be diverted by three-way valve **177** either back to the reservoir or to a recovery or waste treatment facility.

The air cylinders which raise and lower the nozzle banks, and the air cylinders for opening and closing the bay doors, including the end doors and the overhead maintenance door, if any, are actuated through suitable pneumatic feed lines **179** connected to a compressed air source through suitable pneumatic control valves or the valve board **160**.

FIGS. **11–12** generally illustrate the configuration by which cascaded cleaning bays are operated under the control of a host CPU and distributed bay CPUs, and FIGS. **14–19** are flow charts describing the software functions by which the host and bay CPUs communicate with each other, process bottle type information, and carry out the necessary machine control functions for processing successive container trays through multiple cleaning bays.

Referring to FIG. **11**, five cleaning bays **181,182, 183, 184, 185** are shown cascaded together under the control of a host CPU **187**. As earlier described, each bay processes the containers through selected cleaning and rinse solutions and can include one or more bays for air drying the containers. In FIG. **11**, the sequence is a first bay **181** for tap water with detergent followed by three rinse bays **182, 183, 184** which, in turn, provide a nitric acid rinse and two de-ionized water rinses. The final bay **185** air dries the containers: in this bay the fluid stream emitted by the nozzle banks is air.

As shown in FIG. **12**, each cleaning bay has its own local bay CPU **180** to provide local process control. The inputs and the outputs of the motors, sensors, and control valves of the bay are all handled by the bay CPU through suitable I/O ports **191**. The bay CPUs for the cascaded bays are preferably daisy-chained together from the host CPU via a serial RS485 communications link for long distance control capabilities.

The sensor inputs for each bay CPU are diagrammatically illustrated in FIG. **13** wherein the bay CPU **180** is shown as receiving chain position information from the servo motor encoder **53** and from the chain's home position sensor **55**; tray position information from the tray contact switches **59, 61, 63**; nozzle bank height or z-axis position information from the Hall Effect sensors **135** on the air cylinder nozzle bank roller assembly; nozzle bank x-axis position from the lead screw encoder **108**; an indication of the position of the end doors **19, 21** such as from suitably located contact switches (not shown).

The host and bay CPUs, each of which can suitably be based on a Motorola Z80 microprocessor and each of which has associated memory capacity suitable to its task, have a communication protocol below described which allows the host CPU to poll and send and receive information to and from the individual bay CPUs. This information will include container or bottle type information in a "look-up table" stored in the memory associated with the host CPU. The bottle type look-up table is accessible by the bay CPUs to obtain container height, spacing, and row count criteria for selecting one of the independently operable nozzle banks, for establishing the height of travel of the selected nozzle bank, and for setting the parameters under which the nozzle banks are advanced by the lead screw. Operator access to the

host CPU is through a suitable keyboard and display terminal. As described below, the operator, in addition to designating bottle types to be processed, can through keyboard commands also edit the bottle type look-up table to add, delete or change bottle type information. It is understood that programming the CPUs to carry out the functions and capabilities herein described can be accomplished by persons of ordinary skill in the programming arts using routine programming techniques.

Turning to the flow charts of FIGS. **14–19**, it is first noted that communications between the host CPU and remote bay CPUs is packet driven, that is, the host CPU continually sends out data packets to the bay CPUs with an address byte which tells which of the bay CPUs it is talking to. The data packets, which may be 20 to 30 bytes long, are capable of addressing the bay CPUs as to their status and the type of container being processed. The bay CPU responds by sending a corresponding data packet back to the host CPU, with the information conveyed by the return packet being reflected on the host's display terminal. If a data packet is not returned, a malfunction of a bay CPU would be evident, at which time the operator can shut down the machine.

FIGS. **14A** and **14B** show the main event loop of the host computer in which keyboard commands by an operator are processed by a keyboard polling routine (block **201**). The first level of commands is a "Test Operation" screen menu (block **203**) in which operator can enter the commands "Start", "Stop", "Purge", "Open", "Close", "Drain" (blocks **205,207,209, 211, 213, 215**), or other suitable commands all of which cause a data packet (block **229**) to be circulated to the bay CPUs. The host processes the keyboard commands (blocks **217, 219, 221, 223, 225, 227**) by sending a data packet to the bay CPUs or by taking the operator to a secondary "Test File" menu (block **231**) shown in FIG. **14B**. From the "Test File" menu the operator can input container (bottle) type information (block **232, 235**), edit bottle type information (blocks **237, 239**), or initiate other operational functions such as viewing current processing statistics relative to previous processing runs (e.g., the number and types of bottles processed in a given time period) (blocks **241, 243**). The "Test File" menu also includes a print command (block **245**), and a command for adding users to the system by establishing additional user codes (blocks **247, 249**). The screen menu program routines will continuously monitor whether the machine has stopped, and will quit when it has (blocks **251,253**).

FIG. **15** generally illustrates the communications routine needed by the host CPU to insure that remote bay CPUs properly receive data packets from the host. This routine tests whether the remote CPU responds within a certain number of tries as determined by a counting routine (blocks **255, 257, 259**); if after an "x" number of attempts the addressed CPU does not respond, the host reports a "no response" (block **261**) to the operator for appropriate action such as shut down. Preferably an emergency "STOP" switch (not shown) is provided in the event a host "Stop" command (block **207** of FIG. **14A**) is not operative.

The host communication routine can also test the data received back from the CPU to determine if the data is good by using suitable known error checking procedures (blocks **263, 264**).

FIGS. **16–19** illustrate the programmed functions of the bay CPUs. As shown in FIGS. **16** and **17** each bay is initialized upon power up. As shown in FIG. **16**, initialization involves first testing to see if a tray is resident within the bay and if it is to determine if the next bay in the sequence of cascaded bays is ready to receive the tray (blocks **265, 267**). Assuming the next bay is prepared to receive a tray (i.e., it does not have a resident tray of its own) or the bay is the last bay, the tray is exited through the out feed end of the bay (block **269**). Once the bay is cleared, the CPU directs the bay to move the nozzle banks and drive chain to their home positions in reference to the various above-described sensor inputs (blocks **271, 273, 275**). The communication lines to the host CPU are also initialized (block **277**), and the condition of the bay end doors (and top maintenance door, if any) tested (block **279**). The bay CPU of the initialized cleaning bay then indicates it is ready to receive a new container tray by setting a bay ready bit.

The bay ready bit signals to the bay CPU that it can begin the main event loop shown in FIGS. **18** and **19** for processing the tray of containers (see block **281** of FIG. **17**). In the main event loop, the CPU continually looks for and responds to data packets (requests) from the host CPU as represented by blocks **283** and **285**. It also tests to see if a tray has arrived in the bay from sensory feedback from the tray position contact switches (block **287**). Once a tray has arrived, the CPU checks to see if it has received from the host the necessary bottle type information to process the bottles arrayed in the tray (block **289**), and, once the information has been received, initiates the process cycle illustrated in FIG. **9** for each row of containers held in the tray (block **291**).

The process cycle routine begins by establishing from sensory feedback from the servo encoder **53** that the tray has been properly positioned (block **293**). If the tray is not in position, it actuates the drive chain's servo motor **51** to correct the position (block **295**). The lead screw stepper motor **107** is then actuated to position a selected nozzle bank (manifold) in registration with the first row of containers supported in the tray (blocks **297, 299**; also see FIG. **4**). The air cylinders on the nozzle bank roller assembly are then actuated to raise the selected nozzle bank to a height determined by the bottle type information received by the bay CPU from the host's CPU's look-up table (blocks **301, 302**). When the nozzle bank reaches its designated process height the tips of the nozzle elements will be inserted substantially entirely within the inverted row of bottles being processed at which point the bottles are processed (block **303**) as generally illustrated in FIG. **19**.

The process routine shown in FIG. **19** is part of the fluid control means by which the fluid of the cleaning bay is turned on and off at the right times. The fluid stream is turned on (block **309**) when the nozzle bank is at its maximum height. At this time retraction of the nozzle bank back to its home z-axis position commences (block **313**) and after a suitable time-out the fluid stream is turned off (blocks **313, 315**). Preferably, the time-out occurs just as the nozzle elements exit the bottles. The time-out interval for the fluid stream can be established by a time circuit from the known rate of travel of the nozzle bank and the height of the bottles as reflected in the bottle type look-up tables. Following time-out of the fluid stream, the nozzle bank continues to retract to its home or start position (block **317**).

Processing a row of bottles as above-described is repeated for each row until the nozzle bank arrives at the last row (block **305** of FIG. **18**), at which point the tray is exited from the bay (block **307**) after the end doors are opened and after it is determined that the next bay, if any, can receive a tray. A tray exited from one bay can be picked up by the next bay by extending the tray support rails between bays and by suitably spacing the bays such that a tray handed off by the drive chain of one bay is picked up by the drive chain of the

next bay. Modular bays according to the invention can thusly be cascaded together in any desired number and sequence.

It shall be appreciated that processing the tray of containers in accordance with the invention can be accomplished by means of process steps other than the steps described above. For example, the time out of the fluid stream may be triggered at a point in the z-axis cycle of the nozzle bank other than its maximum height. The fluid stream might alternatively be turned on as the nozzle elements first enter the mouth of the bottle such that the fluid stream sweeps the bottles' interior surfaces in both directions of travel. Actuation of the fluid can also be accomplished by means other than a time out circuit, such as by turning the fluid both on and off from sensory feedback from the Hall Effect sensors.

Therefore, it can be seen that the present invention provides an apparatus and method for cleaning containers in which a direct and consistent fluid stream sweeps substantially the entirety of the containers' interior surfaces to thoroughly clean these surfaces in accordance with strict standards, such as those set by the EPA for environmental sampling containers. The apparatus and method is particularly adapted to batch processing and provides a batch processing method that increases throughput over conventional hand washing and rinsing methods presently used. The invention has the additional advantage of flexibility, in that, it can be adapted to processing different sizes and types of containers and provides for modular units or bays which can be cascaded together in a desired washing and rinsing sequence. While the present invention has been described in considerable detail in the foregoing specification, it is understood that it is not intended that the invention be limited to such detail, except as necessitated by the following claims.

What we claim is:

1. A modular apparatus for cleaning containers having an open mouth end comprising

at least two modular cleaning bays, said modular cleaning bays being interchangeably cascaded together and including a first bay and end bay,

transporting means for transporting a set of inverted containers along a defined container support plain and in a predetermined spaced relationship successively into each modular cleaning bay from said first bay to said end bay, said transport means including a container support tray for holding a set of containers in an inverted position and in a predetermined spaced relationship, continuous guide rails longitudinally extending through each of said modular cleaning bays for movably supporting said container support tray as said support tray advances from cleaning bay to cleaning bay and for holding said container support tray in position within each of said cleaning bays, and support tray drive means associated with each cleaning bay for picking up said container support tray, for positionably moving said container support tray on said guide rails within said cleaning bay, and for exiting the support tray from said cleaning bay,

fluid stream supply means for supplying a selected cleaning fluid to each one of said cleaning bays, said fluid stream supply means having at least one nozzle bank disposed within each of said modular cleaning bays below said container support plain, each of said nozzle banks having a set of elongated nozzle elements arranged in correspondence with the spaced relationship of the set of inverted containers transported into said bays,

means in each modular cleaning bay for registering the nozzle elements of said nozzle bank for said bay with a set of containers transported into said bay,

means in each modular cleaning bay operative over a defined nozzle bank process cycle for cycling the nozzle bank in said bay in a forward and return movement that causes said set of nozzle elements to traverse through the mouth ends of a set of containers registered therewith, and

fluid control means for each modular cleaning bay for activating the bay's fluid stream supply means such that a fluid stream is emitted from said set of nozzle elements when said nozzle elements traverse through a set of containers registered therewith,

the support tray drive means for each of said cleaning bays including position feedback means for precisely positioning said container support tray within its associated cleaning bay during at least one nozzle bank process cycle,

each of said cascaded cleaning bays being fluidly isolated from its adjacent cleaning bays to prevent cross-contamination of fluids.

2. The apparatus of claim 1 wherein said container transporting means includes means for holding a set of containers in aligned rows, wherein the nozzle elements of the nozzle bank of each of said cleaning bays are arranged in at least one row corresponding to the aligned rows of containers supported within said cleaning bays, and wherein said nozzle registration means for each of said cleaning bays includes nozzle bank drive means for advancing said nozzle bank into successive registration with row of containers of said set of containers for a process cycle.

3. The apparatus of claim 1 wherein said fluid stream supply means includes at least two nozzle banks within each of said modular cleaning bays, the nozzle banks within each of said cleaning bays being independently operable for cleaning different container sizes.

4. A method of cleaning containers having an open mouth end comprised of the steps of

transporting a set containers in an inverted position into and out of successive cascaded cleaning bays, each of said cleaning bays being fluidly isolated from and interchangeably connected to its adjacent cleaning bay and each of said cleaning bays having at least two independently operable sets of nozzle elements for emitting a fluid stream of a selected solution, said sets of nozzle elements being adapted to clean different sized containers,

in each cleaning bay, supporting the set of containers transported into the cleaning bay generally above the set of nozzle elements in said cleaning bay,

in each cleaning bay, operatively selecting a set of nozzle elements depending on the size of the set of containers being processed,

registering the set of nozzle elements in each cleaning bay with the mouth ends of the set of inverted containers supported therein, and

in each cleaning bay, cycling said set of nozzle elements in a forward and return movement to cause said nozzle elements to traverse through the mouth ends of the set of containers registered therewith to provide direct fluid stream of a selected solution to inside surfaces of said containers.

* * * * *

UNITED STATES PATENT AND TRADEMARK OFFICE

CERTIFICATE OF CORRECTION

PATENT NO. : 5,566,695

DATED : October 22, 1996

INVENTOR(S) : Levey et al.

It is certified that error appears in the above—identified patent and that said Letters Patent is hereby corrected as shown below:

Col. 14, line 31, Claim 2, add "each" before "row".

Signed and Sealed this

Twenty-fifth Day of March, 1997

Attest:

Attesting Officer

BRUCE LEHMAN

Commissioner of Patents and Trademarks

UNITED STATES PATENT AND TRADEMARK OFFICE

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Attesting Officer

Commissioner of Patents and Trademarks

[redacted]

US006223502B1

(12) **United States Patent**
Cress et al.

(10) **Patent No.: US 6,223,502 B1**
(45) **Date of Patent: *May 1, 2001**

(54) **METHOD AND APPARATUS FOR WASHING WARES FOR FOOD AND FILLING WARES WITH FOOD**

(75) Inventors: **Fred W. Cress**; **Peter R. Simon**, both of Mississauga; **Anthony G. DiMarco**, Woodbridge; **Luigi J. Priolo**, Etobicoke; **Peter J. Clarke**, Richmond Hill; **Darcy J. Hawkins**, Brampton, all of (CA)

(73) Assignee: **Cara Operations Limited**, Toronto (CA)

(*) Notice: This patent issued on a continued prosecution application filed under 37 CFR 1.53(d), and is subject to the twenty year patent term provisions of 35 U.S.C. 154(a)(2).

Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **09/049,082**

(22) Filed: **Mar. 27, 1998**

(30) **Foreign Application Priority Data**

Mar. 26, 1998 (CA) 2233404

(51) **Int. Cl.**[7] **B65B 55/04**

(52) **U.S. Cl.** ..... **53/426**; 53/167; 134/25.2; 134/58 D

(58) **Field of Search** ..... 53/426, 167, 431; 134/25.2, 48, 56 D, 58 D

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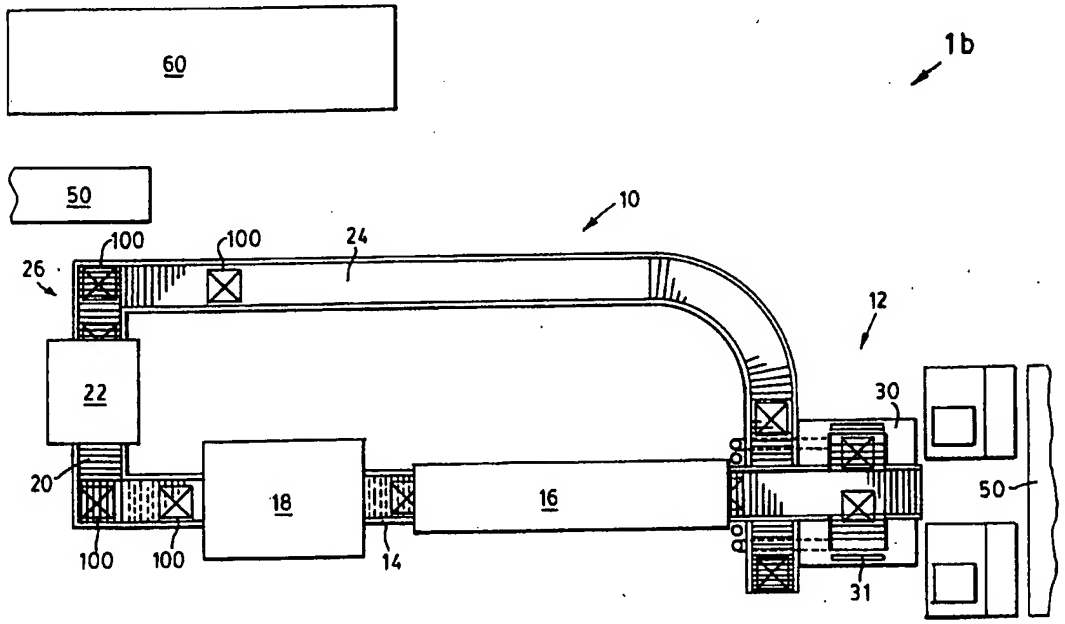
Primary Examiner—Stephen F. Gerrity
(74) *Attorney, Agent, or Firm*—Bereskin & Parr

(57) **ABSTRACT**

A method and apparatus are provided for cleaning and refilling wares for delivering food, e.g. trays, plates, bowls and cutlery, as might be used on airlines and in the health care industry. The wares are provided in sets and kept together in sets. After washing of each set, it is cooled if necessary and immediately refilled, for reuse. This can be achieved by providing a conveyor line along which are arranged a washer, dryer and cooling unit to keep the wares together. The invention provides a basket, configured to hold a number of sets of wares, the exact number depending upon the types of wares.

16 Claims, 11 Drawing Sheets



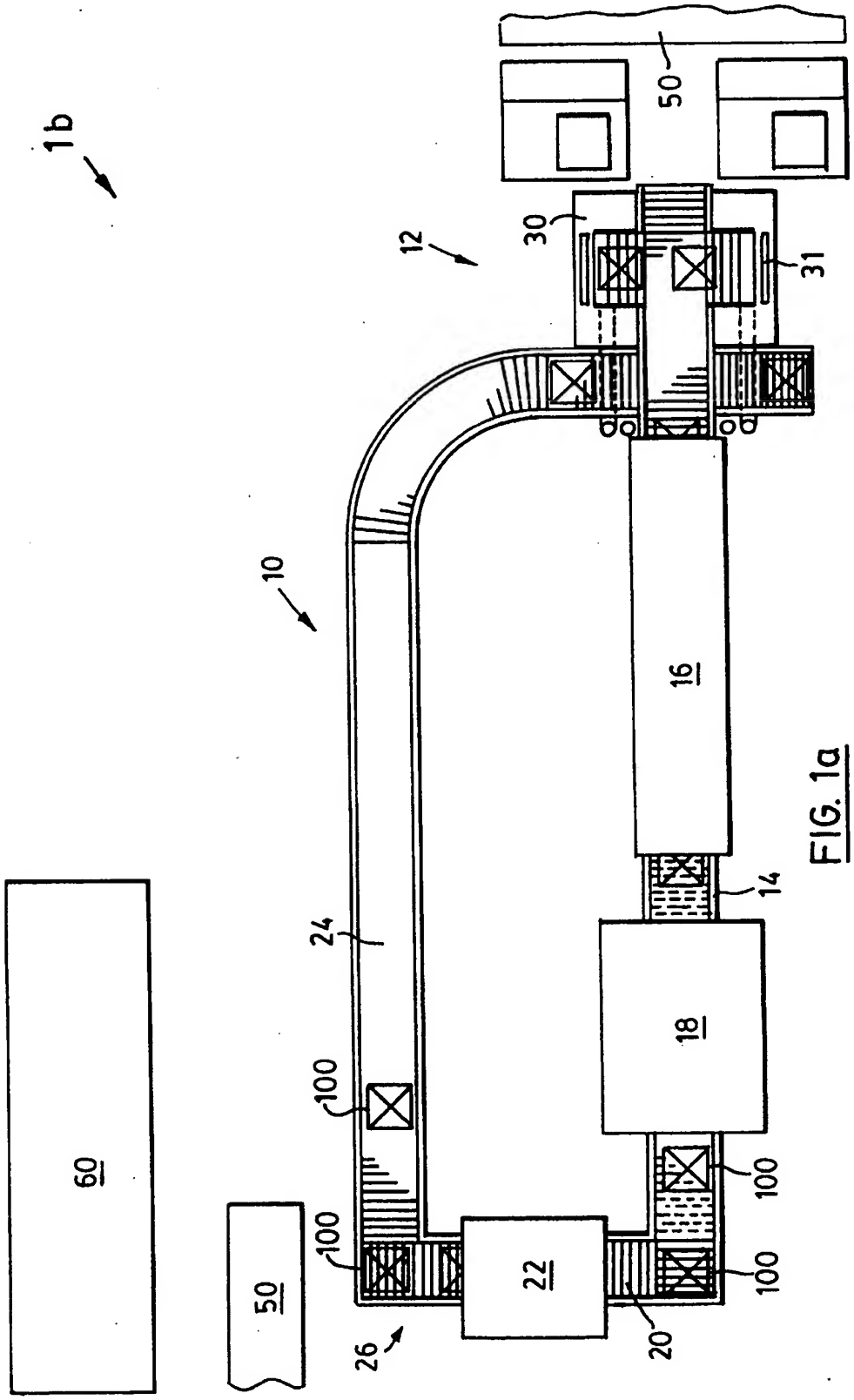


FIG. 1a

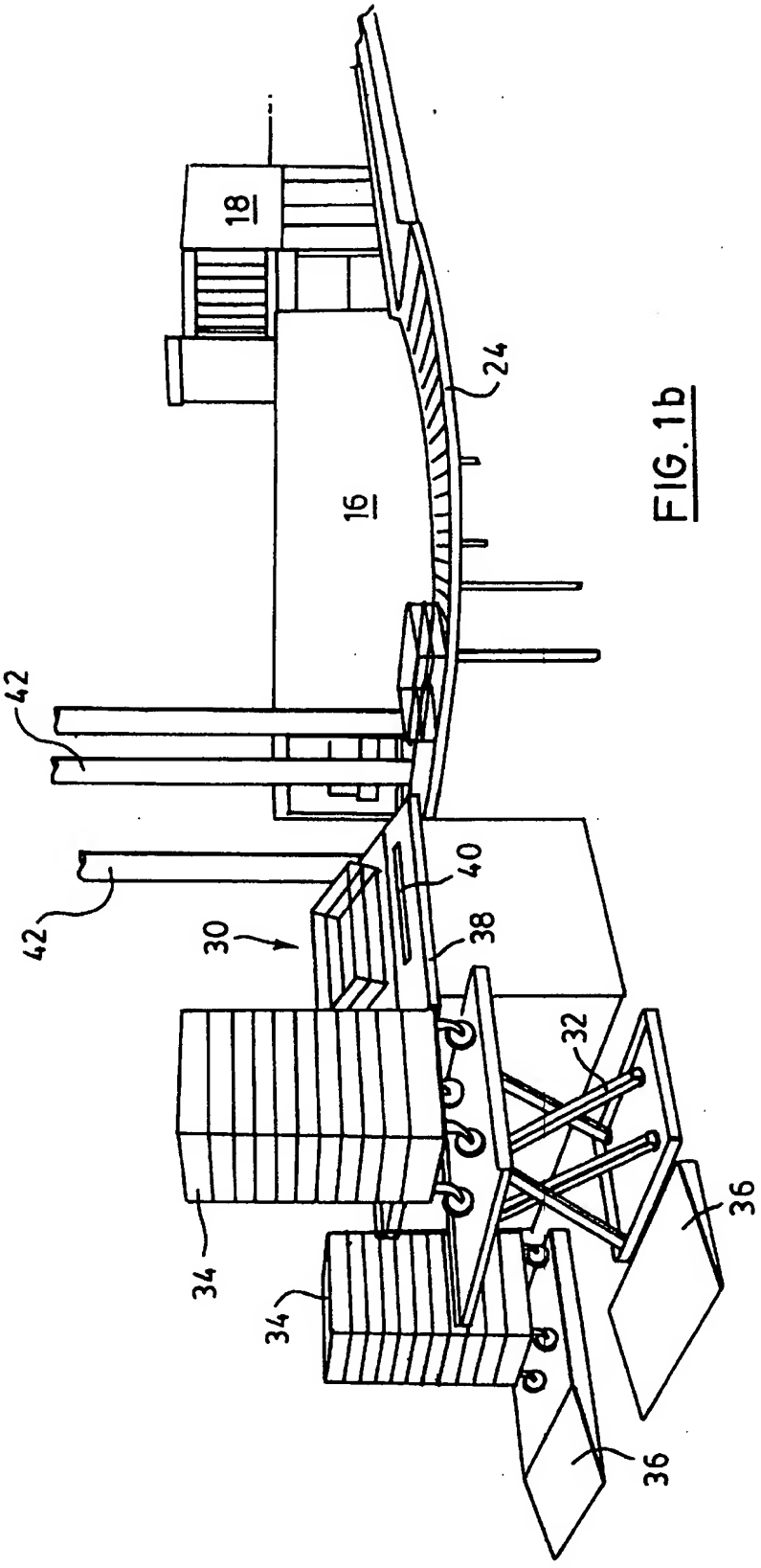


FIG. 1b

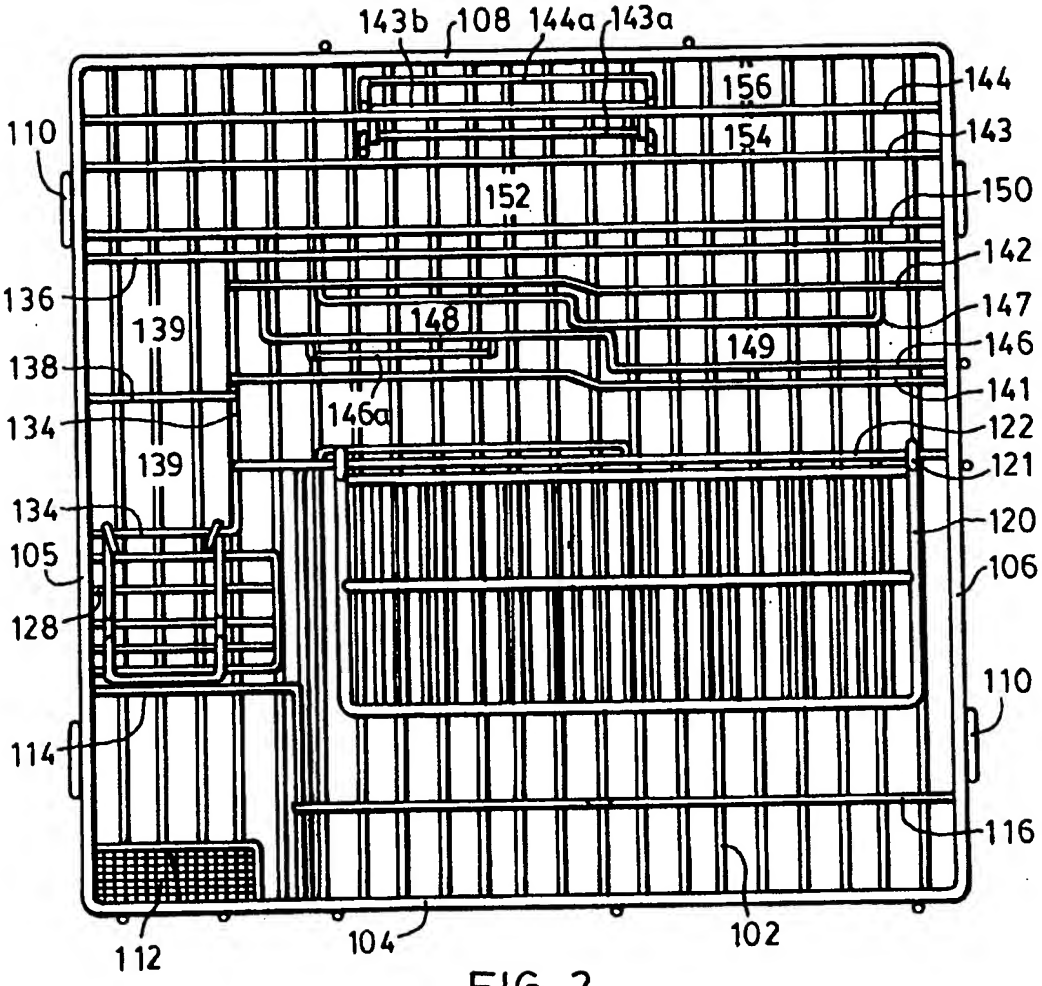

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FIG. 2

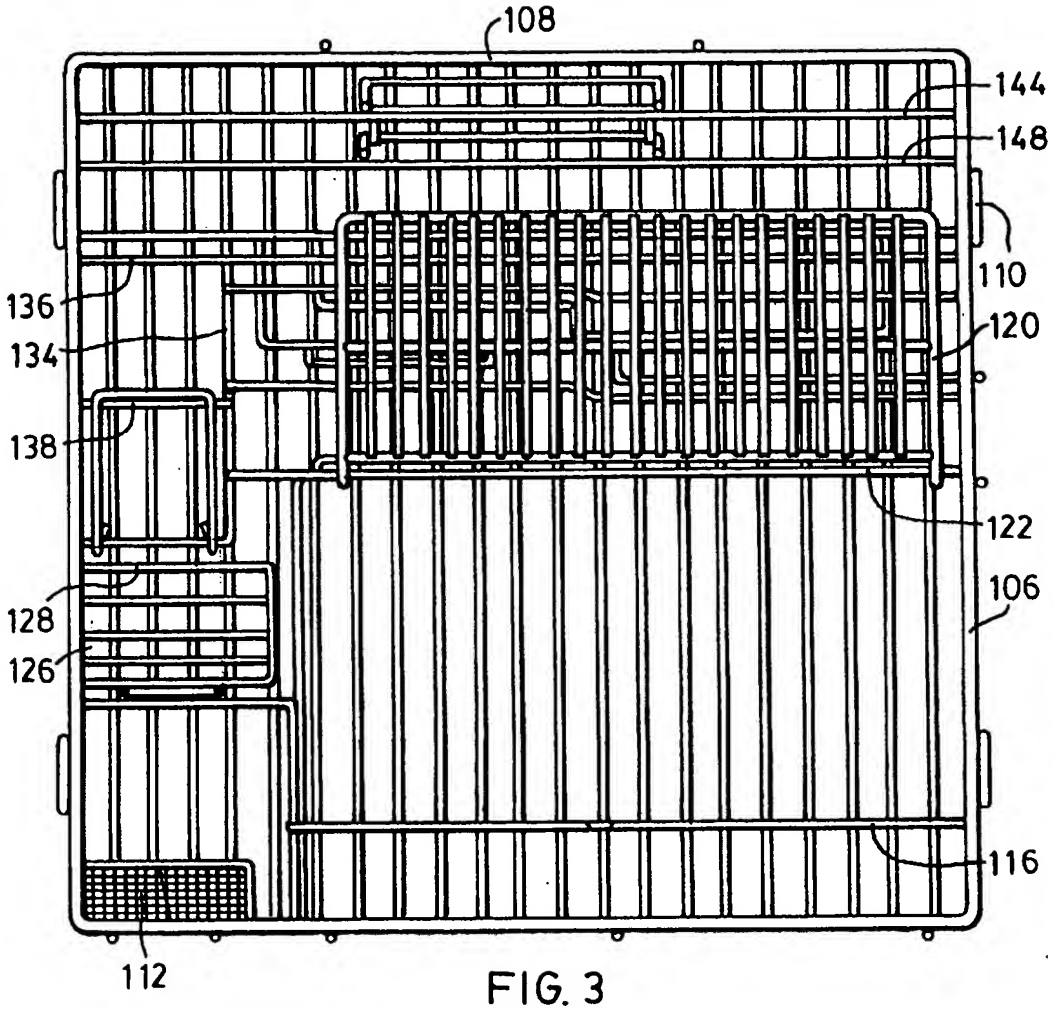

FIG. 3

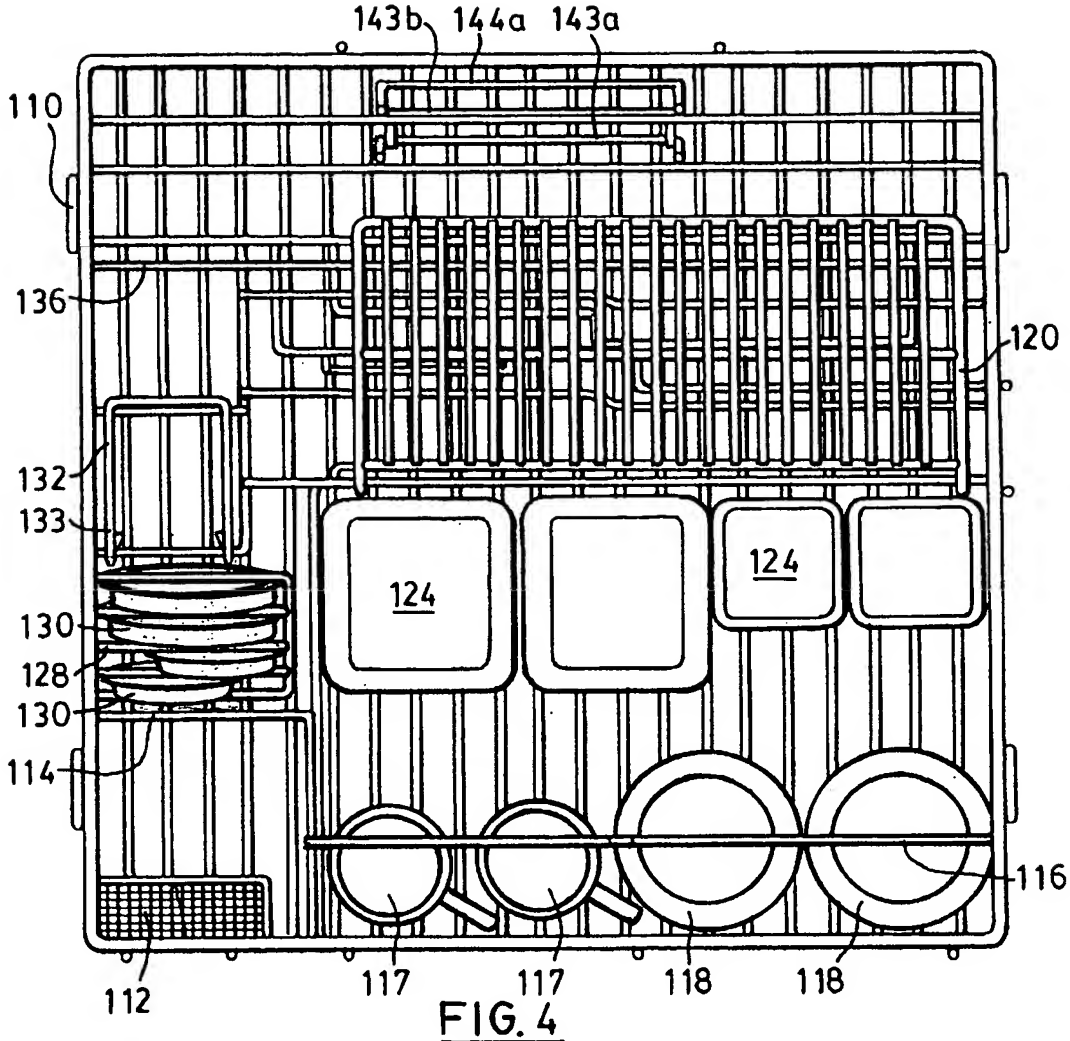
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FIG. 4

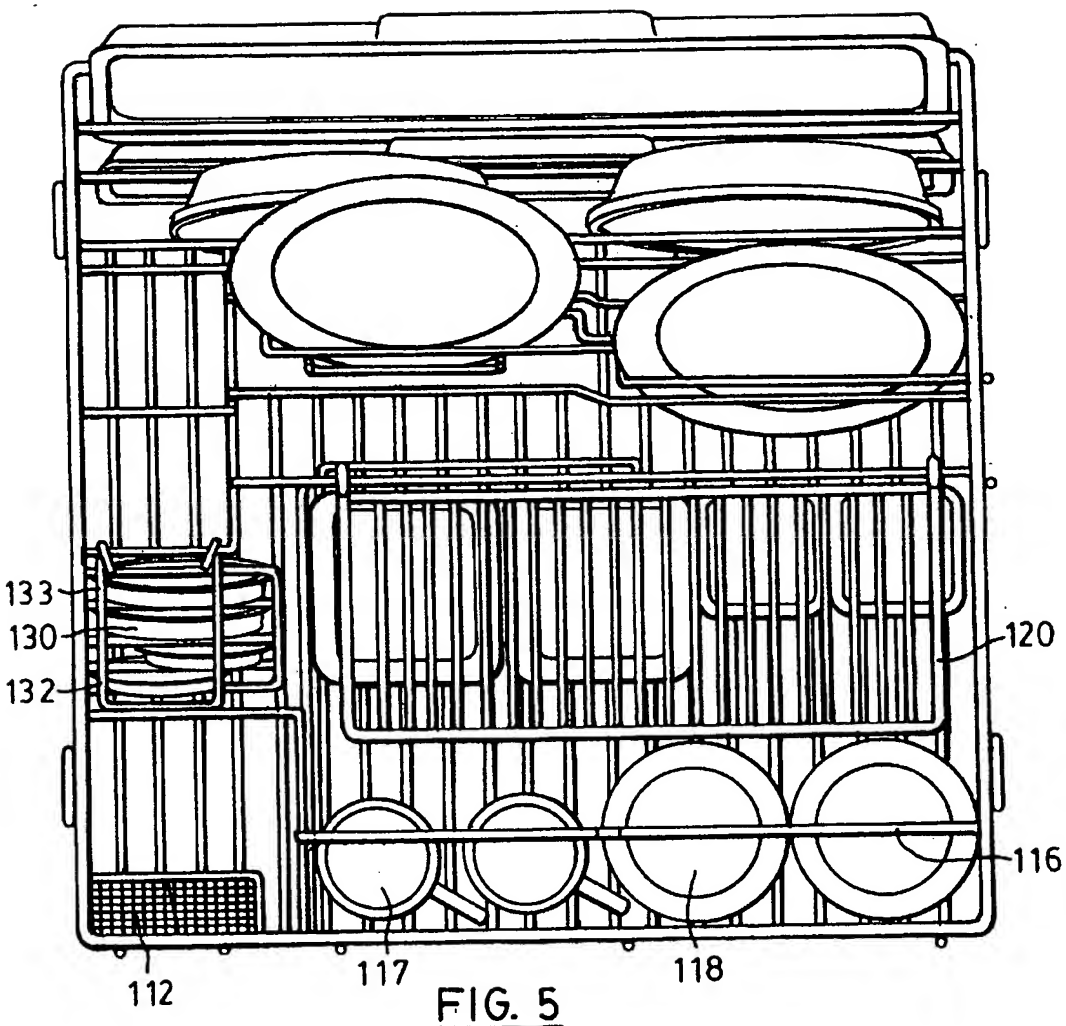

FIG. 5

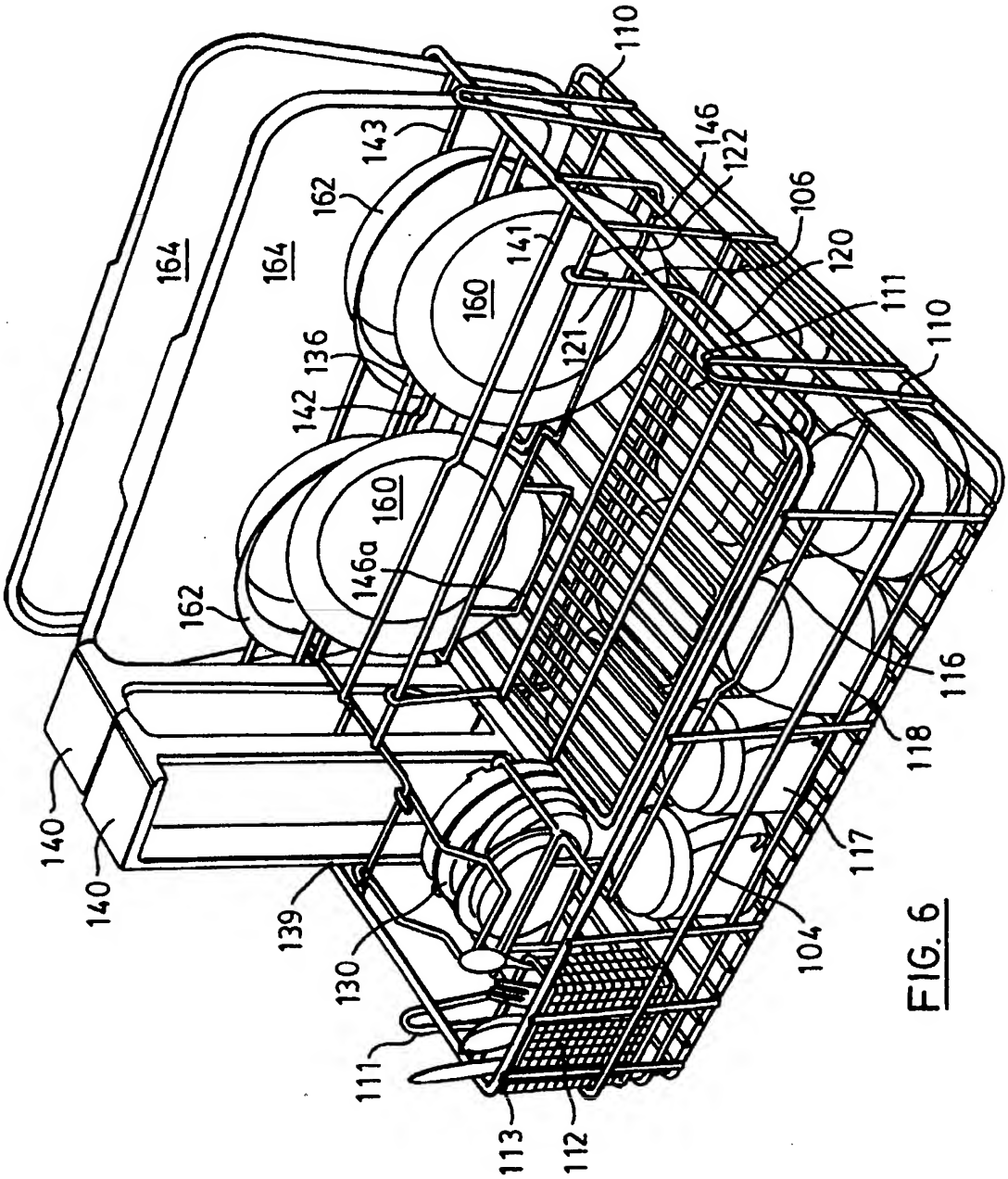
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FIG. 6

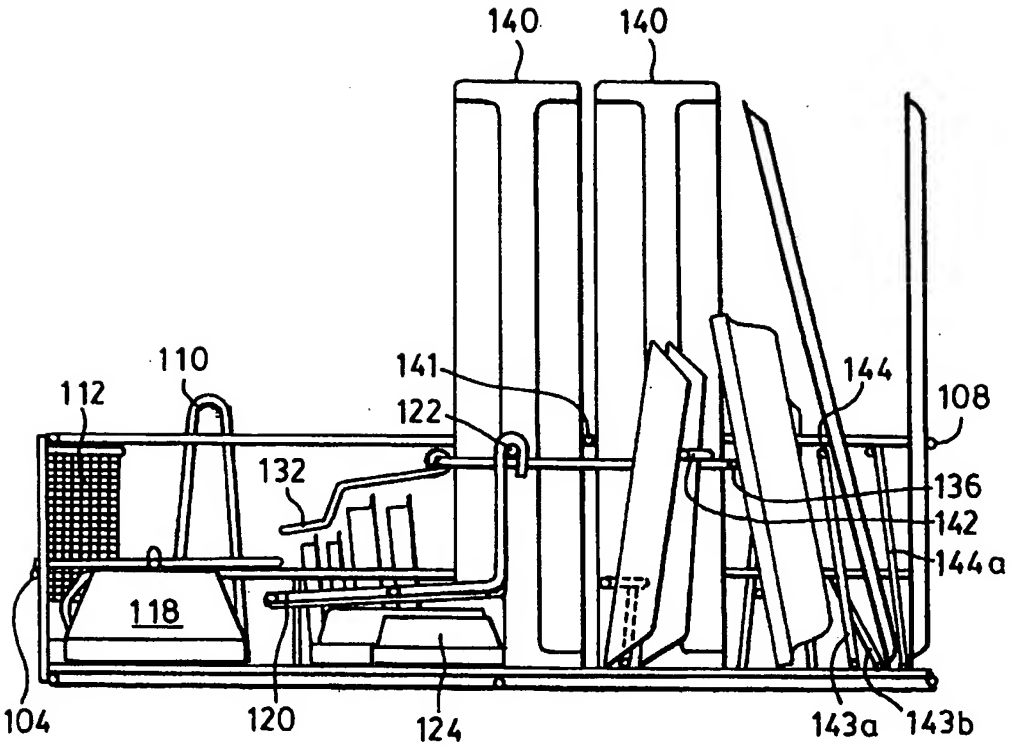
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FIG. 7

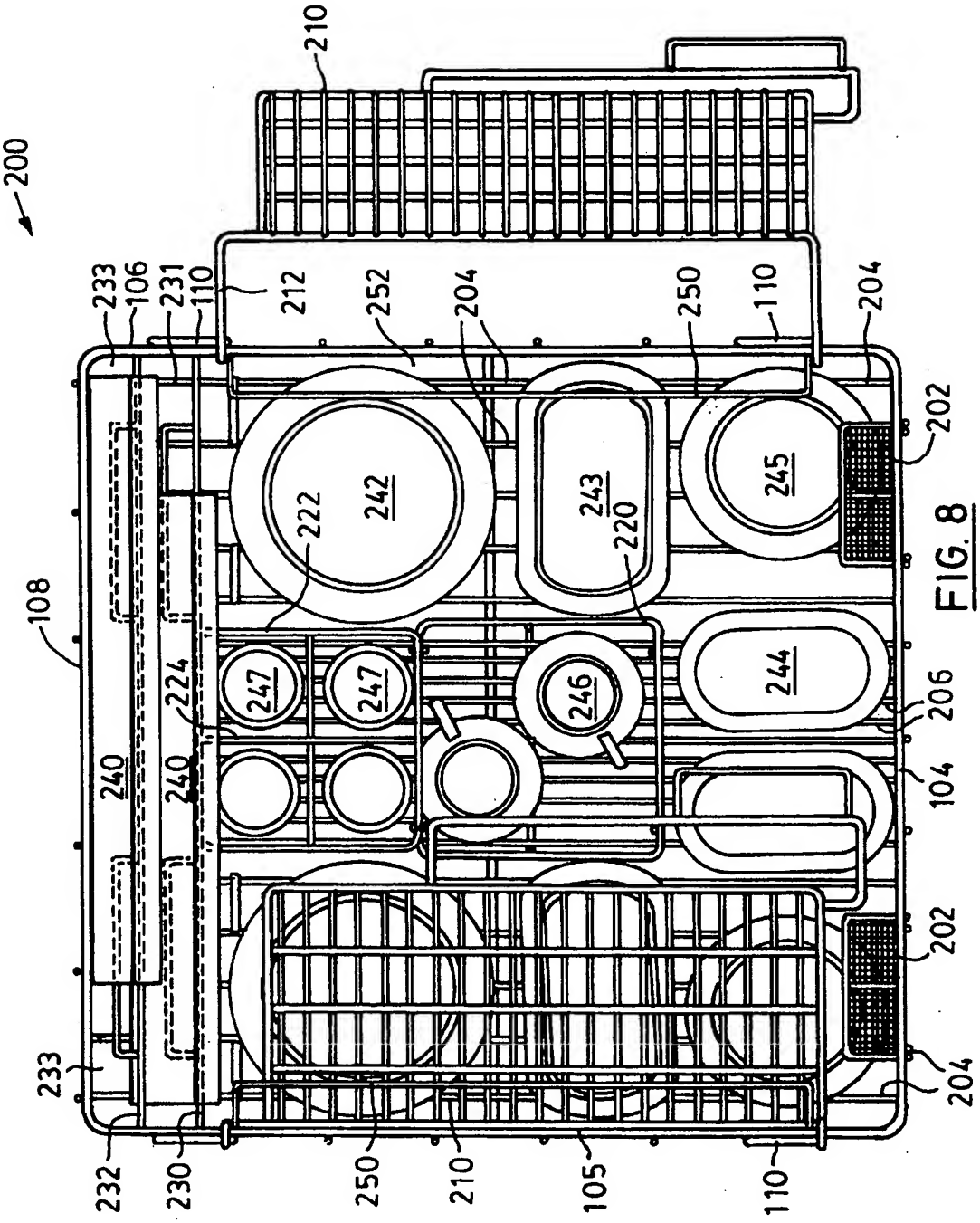
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FIG. 8

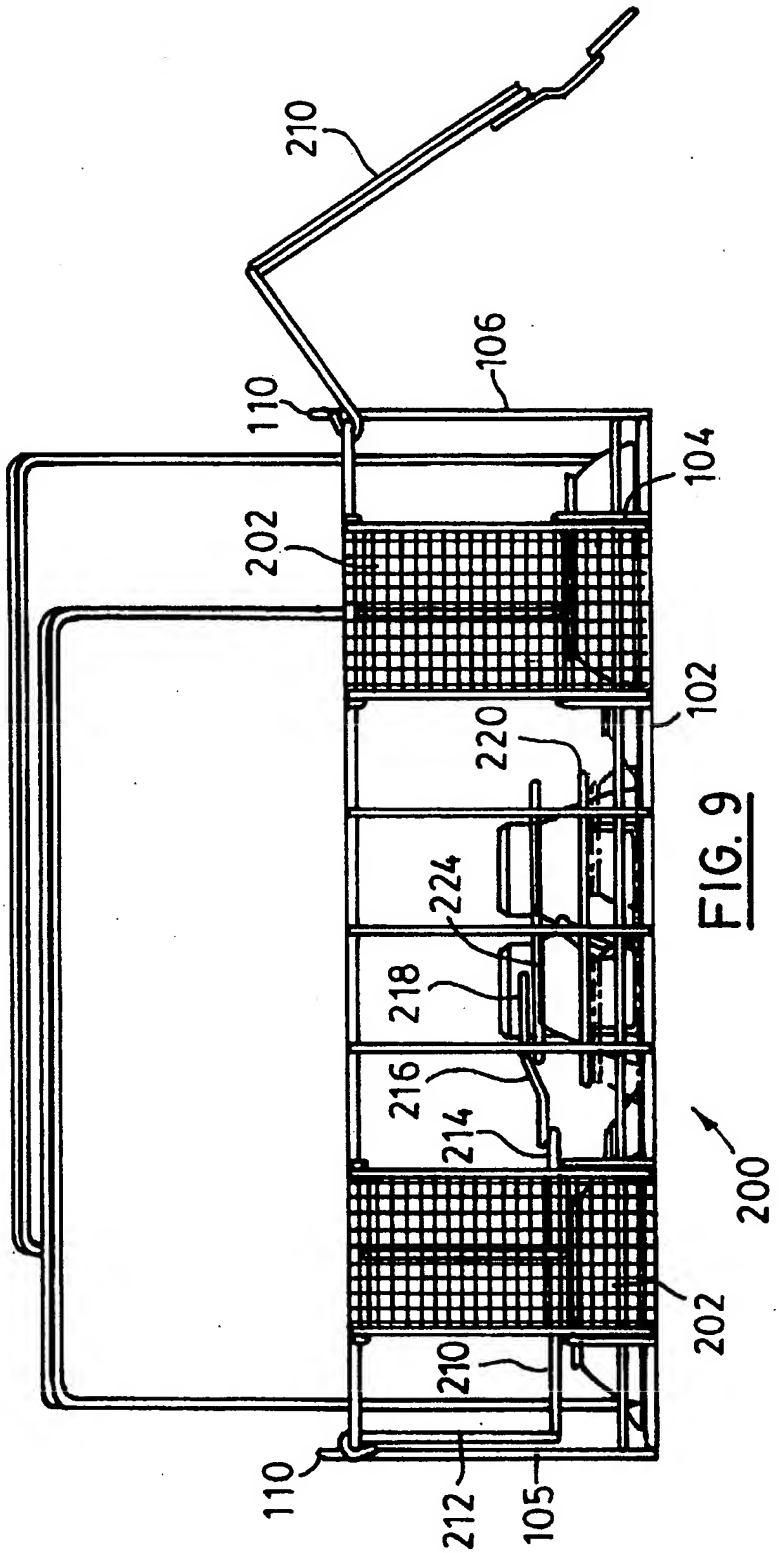
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FIG. 9

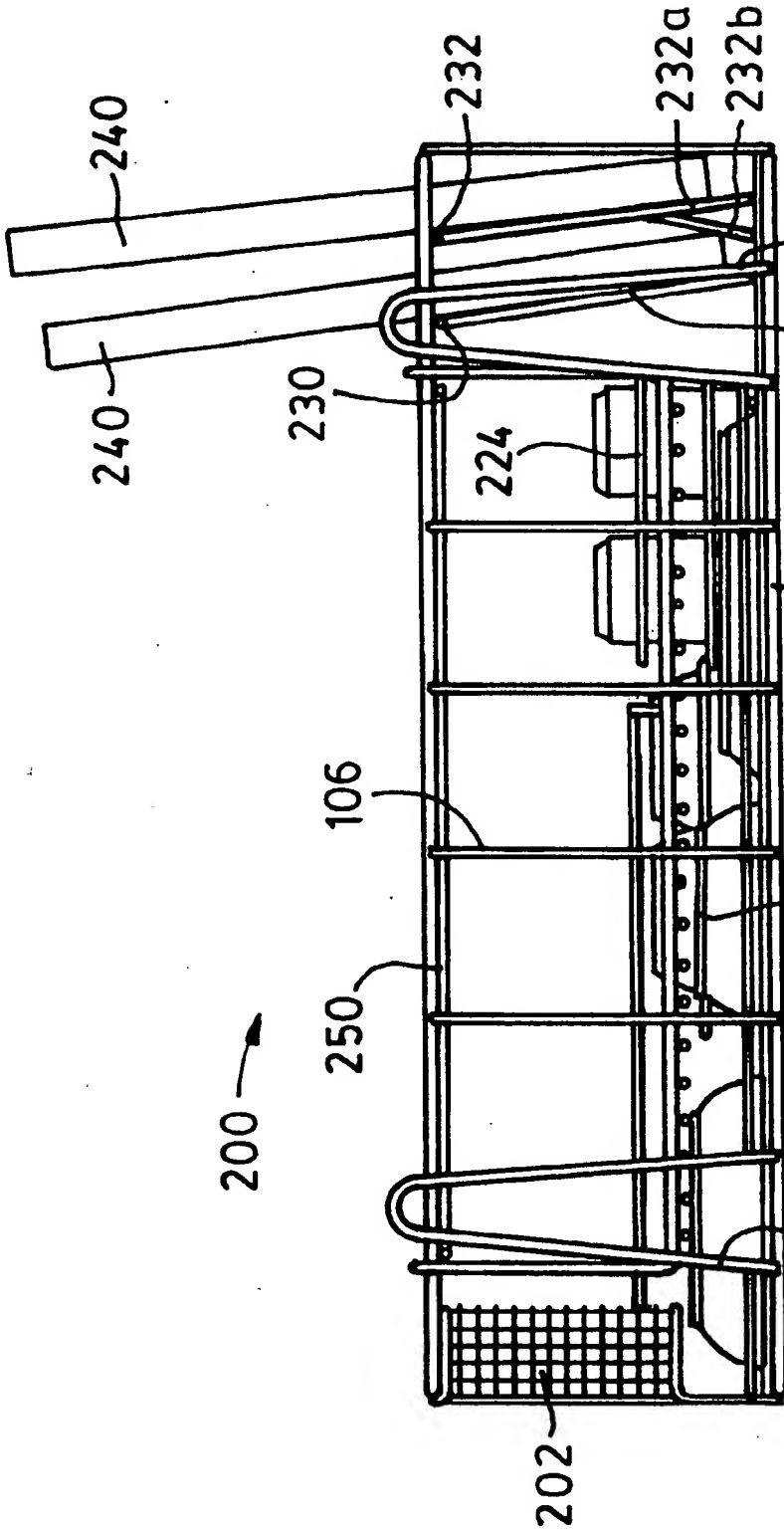
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FIG.10

METHOD AND APPARATUS FOR WASHING WARES FOR FOOD AND FILLING WARES WITH FOOD

FIELD OF THE INVENTION

This invention relates to an apparatus and a method for cleaning soiled food containers, utensils, trays etc., and for enabling a tray to be assembled with a required complement of wares, e.g. bowls or other food containers and utensils and filling the containers with food. This invention has applicability in any large institution or organization including airlines, hospitals, other health care institutions and the like.

BACKGROUND OF THE INVENTION

It has long been known to provide meals for aircraft passengers, by preparing the food in a ground facility or kitchen, and, for each passenger, assembling a tray comprising the necessary bowls, plates, utensils with the food already placed in the bowls etc. This is done for the simple reason that the compact space and weight limitations of aircraft simply do not permit of anything beyond simple reheating and serving of food. Accordingly, much expertise has been developed in promptly assembling meals in this manner, even in relatively large quantities, and arranging for their delivery immediately prior to the departure of flight, to ensure that the food is relatively fresh.

Many large institutions have also had a requirement to prepare meals or food in large quantities, and arrange, in effect, for each meal to be delivered individually to a person. This commonly arises in hospitals and institutions caring for elderly people. Traditionally, such institutions would have a kitchen on site, and the meals would be prepared, and delivered from the kitchen immediately by a trolley or cart to the patients.

More recently, for such institutions, it has been recognized that there are advantages to preparing meals or food in a more systematic way, possibly even using an external facility, so that the food is then prepared and delivered in a manner analogous to the preparation and delivery of airline meals. Equipment has been developed which enables trays to be loaded with some food which is to be served warm, e.g. a traditional hot meal, and other items, e.g. dairy products, which are to be kept cold. Such trays are provided with a central divider, separating the tray into two halves. Such trays are then loaded into a special container or cart which is provided with ducting, so that one side of each tray can be chilled with cold air, and immediately prior to handing out the trays to the individuals, the other side of each tray has warm or hot air passed over it to reheat or rethermalize the food on that side.

However, a fundamental problem with any such technique is the handling of the wares, and in this specification including the claims, the term "wares" encompasses trays, plates, bowls, cups, utensils and any other reusable items necessary to deliver food and beverage. There is the problem of assembling the wares to make up complete or loaded trays and the handling of soiled, returned wares. The traditional approach, used by flight kitchens for airlines and the like is to treat the two operations of cleaning soiled wares and preparing fresh trays as entirely separate.

Thus, a conventional kitchen, for preparing of airline meals, soiled trays etc., are commonly received in standard carts. These are unloaded, and the individual wares, i.e. trays, bowls, cups, knives and forks are separated and placed on a conveyor, which takes them through a large washing and drying unit, where the wares are washed and dried. At the exit from this unit, the individual items are collected, stacked and placed in separate storage. Usually, the wares are quite warm as a result of the washing and drying process, but this is not a disadvantage where the wares are placed in storage, and indeed there may even be benefits in driving off any remaining moisture.

Here, it should be born in mind that each airline usually has their own line of crockery or utensils, bearing the airline's insignia. Consequently in these kitchens, there is the need to handle a wide variety of different bowls, plates and other wares, and to keep these separate. Also, even for any one airline, there is usually a difference between the wares used for tourists or ordinary class passengers and that used in business or first class, which again increases the number of different types of wares that have to be stored and handled. Thus, it is common for a flight kitchen to have a relatively large storage area where all of the different types of wares etc. are stored.

When it is desired to prepare food for a particular flight, the appropriate trays, crockery and other wares are pulled from storage, and delivered to a separate section of the flight kitchen. There, individual trays are made up, commonly comprising a tray, a number of bowls, cups, cutlery and condiments. The cutlery may either be reusable, commonly stainless steel cutlery or disposable plastic cutlery. In either case, it is common for the necessary items of cutlery to be separately packaged, often with individual packets of condiments and the like, or enclosed in a plastic bag. As a matter of convenience in assembling the tray, the bag containing these various items is often placed on the tray at the end of the assembly process. The tray with the bowls is passed along a conveyor belt or line, and the individual food items are placed on it sequentially, both to enable the trays to be assembled quickly, and to ensure consistency and uniformity.

Depending upon the exact timing, the completed trays may be dispatched immediately from delivery to an aircraft, or alternatively may be held in a large, refrigerated storage facility. It should also be born in mind that passengers often have requirements for specific meals, to meet dietary requirements, religious laws and the like. These, usually, must be prepared individually, and then stored with the main part of the shipment, for delivery to the individual aircraft.

Generally similar techniques are used, when preparing food for hospitals and other institutions. The main difference is that, for airline use, the trays, bowls etc. are often quite compact, and airline passengers recognize and accept that compact equipment has to be used in the confined space of an aircraft. On the other hand, wares for use in hospitals and the like are usually of more conventional dimensions, so as to be significantly larger than those found on aircraft. This, in turn, creates complexity if a kitchen is to be configured to handle all types of wares. As noted, it is also becoming more common, for such institutional use, to provide trays, which often will be much larger than airline trays, with a central divider separating the tray into two parts, to enable both hot and cold food to be delivered simultaneously.

SUMMARY OF THE INVENTION

Accordingly, the inventor of the present invention has recognized that it is desirable to provide a more streamlined and efficient way of handling these wares. More particularly, the present inventor has realized that it is desirable to eliminate the storage of cleaned crockery etc. and, in effect, to provide immediate turnaround or reuse of the equipment

once it has been cleaned. This then avoids the problem of sorting and storing different types of wares and subsequently locating and retrieving appropriate equipment for an individual flight.

In accordance with a first aspect of the present invention, there is provided a method of washing wares for food and filling the wares with food, the method comprising:

(1) receiving sets of soiled wares, each set comprising a plurality of wares intended to be used together for one individual;

(2) passing the wares through a washing and drying means, in which the wares are washed and dried;

(3) cooling the wares down to a temperature low enough to permit immediate refilling of the wares with food; and

(4) reassembling the wares into sets and refilling the wares with food, whereby each set is ready for delivery to an individual;

wherein steps (2), (3) and (4) are carried out substantially continuously and sequentially.

Preferably, in steps (2) and (3) the wares are kept together in sets. Commonly, each set of wares will comprise a tray and other wares carried by the tray.

The method can be carried out by placing the wares directly onto a conveyor. However, in a preferred aspect of the present invention, the method is carried out using a plurality of baskets, each of which is intended to hold at least one complete set of wares, wherein step (1) includes loading each set of wares into a basket, steps (2) and (3) comprise sequentially passing the baskets loaded with sets of wares through a washing and drying means and through a cooling means, and step (4) comprises removing each set of wares from the baskets and returning the baskets for reuse.

Depending on the wares, each basket can be adapted to hold two or four sets of wares. Then, in step (1) two or four sets of wares, as required, are loaded into each basket and, in step (4), all the sets of wares are unloaded from each basket.

The method is advantageously carried out by providing a substantially continuous conveyor means, including an input station at one point on the conveyor means and a discharge station at another point on the conveyor means, the washing and drying means and the cooling means being provided along the conveyor means, wherein step (1) comprises receiving sets of soiled wares at the input station, loading soiled wares into baskets at the input station and loading the baskets with the soiled wares onto the conveyor means, whereby the baskets are transported by the conveyor means through the washing and drying means and then through the cooling means, and wherein step (4) comprises receiving the baskets at the discharge station and removing and reassembling the sets of wares from the baskets and then returning the baskets along the conveyor means to the input station.

In accordance with another aspect of the present invention, there is provided an apparatus for washing soiled wares and providing the wares ready for refilling and reuse, the apparatus comprising:

an input station for receiving soiled wares;

a discharge station for removing clean wares and reassembling wares into sets of wares;

a substantially continuous conveyor means extending between the input station and the discharge station and back from the discharge station to the input station;

a washing and drying means provided on the conveyor means; and

a cooling means provided on the conveyor means, the arrangement being such that baskets containing sets of wares are sequentially subject to washing, drying and cooling between the input and discharge stations.

Advantageously, the washing and drying means comprises a separate washing unit and a separate drying unit. To enable greater throughput, the input station preferably comprises two input locations on either side of a conveyor.

As mentioned, the invention can be carried out by placing the wares directly onto a conveyor. However, it is preferred to handle the wares in sets in baskets, and in this case the conveyor means is then adapted to convey baskets, each holding at least one set of wares, wherein the baskets and the conveyor means are adapted to permit free flow of water for washing and air for drying.

A further aspect of the present invention provides a basket for conveying at least one set of wares comprising a tray, and containers for food, the basket having a generally open structure to permit free flow of water and air and the basket comprising:

a base adapted for supporting the basket on a conveying means;

a compartment for holding the tray of each set; and

a compartment for holding each food container, the arrangement being such that the wares are maintained spaced apart from one another, to enable the wares to be washed and dried.

Preferably, the basket includes a retention means for holding lighter food containers in position. More preferably, the basket is adapted for holding a plurality of sets of wares, each set of wares including a tray, the basket including a plurality of slots arranged parallel to one another, for holding the trays. Conveniently, the slots for the trays are provided adjacent one edge of the basket, and a basket additionally includes slots for larger wares, provided adjacent the slots for the trays.

Preferably, the basket includes: a first area for food containers to be placed in an inverted position, to ensure draining of the food containers; first retention means for retaining the food containers in position in the first area; a second area for holding lids for food containers; and a second retention means, for ensuring the lids are retained in position in the second area. The basket can also include a portion not covered by the first retention means and the basket then includes a fixed retention member above said portion of the first area under which open containers can be placed so as to be retained in position.

Preferably, the basket also includes at least one of: an insert container for receiving cutlery; and locations for receiving tray dividers.

BRIEF DESCRIPTION OF THE DRAWINGS

For a better understanding of the present invention, and to show more clearly how it may be carried into effect, reference will now be made, by way of example, to the accompanying drawings, which show a preferred embodiment of the present invention, and in which:

FIG. 1*a* is a plan view of an apparatus in accordance with the present invention;

FIG. 1*b* is a perspective view, in the direction of the arrow 1*b* of FIG. 1*a*, showing an input station of the apparatus;

FIG. 2 is a plan view of a first embodiment of a basket for use with the apparatus of FIG. 1 in a closed configuration;

FIG. 3 is a plan view similar to FIG. 2, showing elements of the basket in an open configuration;

FIG. 4 is a plan view, similar to FIG. 3, showing the basket loaded with wares;

FIG. 5 is a plan view similar to FIG. 4, showing the basket in a closed configuration after being loaded with wares;

FIG. 6 is a perspective view of the basket of FIG. 5;

FIG. 7 is a side view of the loaded basket of FIGS. 5 and 6;

FIG. 8 is a plan view of a second embodiment of a basket according to the present invention;

FIG. 9 is a view from the front of the second embodiment of the basket; and

FIG. 10 is a side view of the second embodiment of the basket.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring first to FIG. 1, an apparatus in accordance with the present invention is indicated generally by the reference **10**. The apparatus **10** has an input station **12**. Extending from the input station **12** is a first conveyor **14**, and located around and enclosing the conveyor are a washing unit **16** and a drying unit **18**. At the end of the first conveyor **14**, there is a second conveyor **20**, and a drying unit **22** that is located on and around the second conveyor **20**. A third or return conveyor **24**, for purposes to be described, extends from the end of the second conveyor, back to the input station **12**. A discharge station **26** is provided at the junction between the second and third conveyors **20**, **24**.

As indicated in FIG. 1, an incoming storage area **50** can be provided for carts or the like holding trays of sorted wares. At the discharge end, an output storage area **60** can be provided for holding trays, containing the reassembled wares after filling with food and beverage, as desired.

Turning to details of the input station **12**, this is best seen in FIG. 7. The input station **12** has two separate locations **30** and **31**, which are symmetrical about the conveyor **14**, and for simplicity are described in relation to the input location **30**. The provision of two input locations **30**, **31** enables two operators to work simultaneously, to provide faster loading of a conveyor **14**.

The input location **30** is provided with a scissors lift **32**, (FIG. 1*b*) for conventional carts **34**. These carts **34** can be any suitable cart with the scissors lift **32** being dimensioned accordingly. Commonly, for airline use, the carts **34** will be standard carts as found on airlines, for holding food trays and dispensing them to passengers. A ramp **36** is provided to enable the carts **34** to be rolled on top of the scissors lift **32**, when in a lowered position. The lift **32** then enables an individual cart **34** to be raised to a comfortable working position, so that trays can be readily accessed.

For the location **30**, an input table **38** is provided, which would be immediately in front of the operator, so that the operator would then have the lift **32** and a cart on his or her left.

The input table **38** provides an inclined surface for holding a basket **100** at an inclined angle facing the operator. The basket **100** is an important aspect of the present invention, and enables one or more complete set of wares, i.e. a tray, plates, bowls, cups, cutlery etc. to be maintained together. The basket and its mode of use is described in detail below. For the time being, it is sufficient to note that the returned, soiled wares are loaded into the basket **100**, for transportation through the washing and drying unit **16** and **18** and then through the cooling unit **22**.

The table **38** additionally provides a slot **40** for waste food and liquids. An operator first takes a tray out of the cart **34** and places the tray on the table **38**. Waste food items and other waste, e.g. napkins, foil closures and the like are manually scraped off of the bowls and plates into the slot **40**. As each bowl or plate is scraped clean, it is placed in its appropriate location in the basket **100**. As detailed below, these items are not randomly placed, but the basket **100** is configured to two or more full sets of wares, in a desired pattern. Similarly, the cutlery is placed in the basket **100**, as is the tray itself and any divider for the tray.

The slot **40** is part of a vacuum disposal system and is connected to suction pipes **42**, so that all waste is withdrawn by vacuum to a central waste container.

Once the basket **100** has been loaded, it is placed on a conveyor **14**. For this purpose, the baskets **100** can be held in an inclined position shown in FIG. 1*b* on rollers, so that they can simply be rolled up on the conveyor **14**.

The conveyor **14** then conveys the baskets **100** containing the soiled wares into the washing unit **16**. It is here noted that the washing and drying unit **16**, **18**, the cooling unit **22** and associated conveyors can, individually, be conventional items of equipment, as found in commercial or industrial scale kitchens. Thus, for each installation, appropriate washing units etc can be chosen and, depending upon the space available, appropriate conveyors or the like can be selected to connect the individual units together, to enable continuous and automatic handling of the baskets **100**.

In the washing unit **16**, the bowls, plates and other wares are subject to washing by high temperature, soap and water, in known manner, as followed by a rinsing step. The water is then drained from the baskets and the baskets pass into the drying unit **18**, where the individual items are dried by hot air.

Conventionally, the individual utensils would be washed and dried separately. After drying, they would then be removed, while still warm, and stacked for storage. Moreover, in conventional kitchens, there is no attempt to keep utensils together in sets. In other words, all of the plates would be stored together and similarly the bowls, cutlery etc. would all be stored separately, with like items being stored together.

Here, the baskets **100** keep the equipment together in sets. Additionally, after exit from the drying unit **18**, the second conveyor **20** carries the baskets **100** into a cooling unit **22**. Here, chilled air cools the dried wares down. The reason for this is to enable the bowls, plates to be immediately recharged with fresh food. If they were warm, this would run the risk of promoting growth of bacteria and the like, which could cause food poisoning.

After leaving the cooling unit **22**, the baskets **100** arrive at the discharge station **26**. This discharge station **26** includes a separate table **50**, which can be in the nature of a conveyor, or provided with rollers or the like, to facilitate movement of the trays. The detailed unloading of the trays is described below. Here, it is sufficient to note that the trays are unloaded first and then the other items removed from the basket and placed on the trays in the desired arrangement, on the loading table **50**. The trays then pass down the table **50** and are recharged with food in known manner.

The empty baskets **100** are returned by the third or return conveyor **24** to the input station **12**, for reloading. Additionally, this enables any items that have not been properly cleaned to be returned for a second pass through the washing unit **16**. Thus, at the discharge station **26**, an operator will usually keep a supply of all of the different bowls, plates, utensils, in case any are missing or dirty for any individual sets of equipment. These additional, spare items are then used to make up complete sets on the trays on

the loading table **50**. As noted, any soiled or improperly cleaned items are returned in the baskets along the conveyor **24**.

Reference will now be made to FIGS. **2–7**, which show in detail a first embodiment of a basket of the present invention. The principal characteristic of this basket **100** is that it holds together a plurality of sets of wares. FIGS. **2–7** show a first embodiment of a basket, intended for holding trays and wares for use in hospitals or other health care institutions. As such, the trays and wares are relatively big and the basket **100** is intended to hold two sets. FIGS. **8–10**, described below, show a basket intended for holding trays and sets of wares for airline use; it is possible that where there is a relatively small number of wares that the basket could be configured to hold four or more sets of wares.

Both embodiments of the basket are formed from wire which is bent and welded together in known manner. The completed basket is then Chrome plated. The baskets could alternatively be moulded in a suitable plastic material.

The basket **100** is generally square in plan with rectangular sides, and has a base **102**, front **104** and left and right hand sides **105, 106** and a rear **108**. In known manner, the base **102** is formed from a parallel array of wires extending from front to back, and secured together by various lateral or cross wires welded thereto. The various wires are all welded to one another in known manner, and chrome plated, but it will be appreciated that the basket could be formed from any suitable material, and may, for example, be molded in plastic.

As shown, the front **104**, sides **105, 106** and rear **108** are formed by three wires which essentially encircle the basket and are supported above the base **102** by spaced vertical wires, to form the basic body of the basket **100**. Welded to the outside of each of the sides **105, 106** is a pair of location members **110**. Each location member **110** tapers inwardly slightly from top to bottom, and projects above the top of the relevant side as indicated at **111**. These projecting parts **111** serve to enable the baskets to be stacked, with the projecting parts **111** engaging the sides of a basket placed above and sliding within the bottom of the location members **110** of the upper basket.

In the left hand front corner, there is a small insert container **112** of fine mesh, for holding cutlery. Surrounding this is a L-shaped wire member **114** defining a small area which can be used for various small items. At the right of this, there is a relatively large area for holding cups and bowls. A cup and bowl retaining wire **116**, as shown, is shaped to retain two cups **117** having a relatively high height and two bowls **118** with a relatively low height.

A first retention frame **120**, as for the base, is formed from a parallel array of wires and includes two upstanding legs **121**, best shown in FIG. **6**, pivotally mounted around a cross member **122**. FIGS. **2** and **6** **30** show the retention member **120** in the closed position. FIG. **3** shows the retention frame swung to an open position, and as shown in FIG. **4**, additional bowls are containers variously indicated at **124** in FIG. **4** can be covered and secured in position by pivoting the retention frame **120** back to the FIG. **6** position.

Immediately above the L-shaped member **114**, there is a lid holding area **126** for holding lids and the like which have a relatively shallow depth. As best seen in FIGS. **2** and **4**, a frame **128** is provided defining a number of parallel slots extending laterally for securing lids and the like, generally indicated at **130**.

To ensure that the lids **130** are held in position, and in particular are not displaced by the force of water cleaning jets, a second retention frame **132** is provided. The frame **132** has legs **133** pivotally mounted to a fixed frame member **134**. Again, FIGS. **3** and **4** show the retention frame **132** pivoted to an open position for loading or removal of the lids **130**.

As shown in FIG. **2** and elsewhere, the frame member **134** is generally L-shaped and extends back to a further cross member **136** to define a rectangular opening divided into two approximately square openings by a dividing member **138**. This defines two square openings **139** for receiving tray dividers **140**, as shown in FIG. **6**.

Behind the cross member **122**, is a series of cross members identified as **141, 142, 143**, and **144**. Between the wires of cross members **141, 142**, there is a pair of additional elements **146, 147**. They extend in a horizontal plane approximately in the middle of the basket. As shown, the intermediate members **146, 147** are secured either to a further intermediate member **150** or to the right hand side **106** of the basket. The intermediate members **146, 147** define two slots **148, 149** for receiving and holding plates as detailed below. Additionally, the front of the intermediate member **146** includes an extension indicated at **146*a*** extending downwardly.

Between the cross member **136** previously mentioned in relation to the square openings for the tray dividers, and the next rearmost cross member **143**, a slot **152**, for receiving plate covers is provided. The further intermediate member **150**, here extending close to the bottom of the basket, but spaced therefrom, serves to ensure that tray covers are tilted forward, as shown in FIG. **6**.

Finally, at the rearmost portion of the basket **100**, the cross members **143, 144** define two slots **154, 156**, for receiving trays. As best shown in FIG. **7**, extending down from each of the cross members **144, 143** is a respective extension **143*a*** and **144*a***. Additionally, extending from the extension **143*a*** is a further extension **143*b***.Each of these extensions is a generally U-shaped wire element having vertical side legs and a horizontal portion.

Thus, in use, the basket **100** is loaded with cutlery **113** in container **112**, and bowls and cups **117, 118** are slid under and retained by the retaining wire **116**. Additional bowls **124** are retained in place by the first retention frame **120** and lids **130** are retained in place by the second retention frame **132**. Tray dividers **140** are placed in the openings **139**. Plates indicated at **160** are placed in the slots **148, 149**. The form of the intermediate members **146, 147** serves to define two slots holding the plates at slightly different angles, and also the left hand plate **160** is held at its lower edge on the extension **146*a***. This is done to ensure full and thorough cleaning of the plates **160** and to ensure that water drains out of them.

A pair of plate covers **162** is placed in the slot **152**, side by side, and as mentioned, the intermediate member **150** serves to angle these covers forward, again to ensure that they are adequately washed by washing jets coming from underneath and through the basket.

Finally, a pair of trays **164** is placed in the slots **154, 156**. The various extension members **143*a***, **143*b*** and **144*a*** ensure that the rearmost tray **164** is held largely upright, while the forward most tray is angled more to the front of the basket **100**, as shown in FIG. **7**. This again is done to ensure that the trays **164** are held accurately and subject to thorough cleaning.

The basket **100**, as loaded and shown in FIG. **6** is placed on the conveyor **14** and passes through the washing unit **16** and drying unit **18**. The conveyors **14, 20** and **24**, in known

manner have an open mesh structure, to permit free passage of water and air. From there, the basket and wares pass through the cooling unit **22**, where the wares are cooled. After the discharge station **26**, the wares are unloaded from the basket **100** and placed on the loading table **50**. In known manner this can include a conveyor assembly, where the tray, reassembled with the bowls, plates and other wares is passed along the line and progressively refilled with the prescribed food. The empty baskets **100** are returned along the third conveyor back to the input station **12**, together with any rejected wares for further cleaning.

Reference will now be made to FIGS. **8**, **9** and **10**, which show a second embodiment of the basket according to the present invention. For simplicity and to avoid unnecessary duplication, like components are given the same reference numeral as in the first embodiment and their description is not repeated. This second embodiment is intended for sets of wares for airline use, and here shows two sets of wares that would be used for first class customers, i.e. where usually a relatively large number of wares are present and the tray and associated wares have relatively large dimensions, to take advantage of the additional space commonly available to first class passengers. For regular airline seating, the space is usually more limited, and hence the trays will be smaller and the number and size of related wares would be smaller, which can then enable a large number of sets of wares to be held in one basket. Thus, a single basket can be configured to hold four or more sets of wares.

Here, the second embodiment of the basket is generally indicated by the reference **200**, and is largely symmetrical as between the left and right hand sides. Thus, on either side the basket **200** includes first and second insert containers **202**, for holding cutlery. As best shown in FIG. **8**, the base **102** is formed with a series of parallel wires running from front to back. Here, these wires essentially comprise a first group of wares **204** on either side of the basket and a second group of wares **206** in the center of the basket. The first group of wires are spaced apart at a relatively large distance and are intended to support relatively large wares, while the second group of wares **206**, as shown, are intended to support relatively small wares, such as cups etc., and for this reason are more closely spaced.

On either side, there is a retention frame, here indicated at **210**. As noted, the construction is essentially symmetrical, and is described further in relation to just one side of the basket **200**, it being understood that the other side corresponds. In FIGS. **8** and **9**, the left hand retention frame **210** is shown in a closed position, while the right had retention frame **210** is shown in an open position.

Each of the retention frames comprises legs **212**, which in the closed position extend vertically downwardly, immediately inside the basket. The legs **212** are continuous with a wire that extends around the periphery of a central frame portion **214**.

Extending from the innermost edge of each frame portion **214** is a first frame extension **216**, which is shown in FIG. **9**, is inclined slightly upwardly at its innermost edge. Extending further from this first frame extension **216** is a second frame extension **218** formed from narrower gauge wire, in known manner. These frame extensions **216**, **218** are intended to assist in retaining larger wares in position, which are not present in this example.

Along the centerline of the basket **200**, there is a first holding area **220** for relatively shallow cups and the like, and a second holding area **222** for larger cups or beakers, which, again as best shown in FIG. **9**, has a taller frame around it, to securely hold the taller wares. The second holding area **222** is divided into four square segments by frame elements **224**.

At the rear of the basket **200**, similar to the first embodiment, there are two cross members **230** and **232** defining corresponding slots **231** and **233**. Extending from the cross members **230**, **232** are extension members **230*a*** and **232*a***. Additionally, as best seen in FIG. **10**, at least one additional extension member **232*b*** is provided, extending forwardly from the rearwardly extending extension member **232*a***.

Thus, in use, this basket **200** would be loaded similarly to the first embodiment. Here, the basket **200** is shown loaded with two trays **240**, and the wares are loaded generally symmetrical about a center line extending between the sides of the basket.

Thus, on each side there is a large bowl **242**, large and small elongate dishes **243** and **244**, and a round bowl **245**. From each set, there is, within the first holding area **220** a cup **246**, and within the second holding area **222** a pair of cups or beakers **247**, these being indicated for the set located on the right hand side of FIG. **8**. Cutlery, not shown, would be placed in the insert containers **202**.

With the basket loaded, the retention frames **210** would be swung into the closed position, as shown, for the left hand retention frame in FIG. **8**. The loaded basket **200** can then be placed on the conveyor at the input station **12** and passed through the apparatus **10**, as detailed above. At the discharge station **26**, it can be removed and unloaded, again as for the first embodiment.

The basket **200** includes an additional wire **250** on either side, approximately at the top of the basket **200**, each of which defines a further slot **252**. The purpose of these further slots **252** is to accommodate smaller trays. Thus, where smaller trays and utensils are provided, then four sets can be loaded into the basket. Two trays would be placed in the rearmost slots **231** and **233**, and two additional trays in the slots **252**. The slots **252** would be loaded with the trays after the retention frames **210** have been swung into the closed position. With the presence of smaller and/or lesser wares, four sets of wares can be loaded in the basket. Thus, the second holding area **222** is already configured to hold four cups or beakers, and if four slightly smaller cups are used, four such cups can be placed in the first holding area **220**. This then enables four complete sets of equipment to be washed and dried simultaneously.

It will be appreciated that while a preferred embodiment of the present invention has been described, many variations are possible within the scope and spirit of the invention. For example, while the invention has been described utilizing a basket for keeping sets of wares together and for passing the sets of wares through the washing and drying units etc., this is not essential. A key concept behind the present invention is to retain sets of wares together and to refill the wares immediately for reuse, rather than store the wares, not in sets, for reuse at a later time.

Thus, it is conceivable that the conveyor system could be configured to take the wares through the washing and drying units and the cooling unit, without requiring a basket. To facilitate keeping the wares in sets, the various conveyors could, effectively, be divided into separate tracks, each track being intended for one particular type of ware, for example one track for plates, another for cups, another for bowls etc. It may well be that such technique would not keep the wares together in sets as exactly as the present invention, but this can be accommodated by providing greater flexibility at the

discharge station **26** and keeping a larger stock of spare wares there, to accommodate any missing items or items that need to be returned for further washing. Such an arrangement may well enable the greater throughput of wares.

We claim:

1. A method of washing wares for food and filling the wares with food, the method comprising:

(1) receiving sets of soiled wares, each set comprising a plurality of wares intended to be used together for one individual;

(2) passing the wares through a washing and drying means, in which the wares are washed and dried;

(3) cooling the wares cooled down to a temperature low enough to permit immediate refilling of the wares with food; and

(4) reassembling the wares into sets and refilling the wares with food, whereby each set is ready for delivery to an individual;

wherein steps (2), (3) and (4) are carried out substantially continuously and sequentially.

2. A method as claimed in claim **1**, wherein, in steps (2) and (3) the wares are kept together in sets.

3. A method as claimed in claim **2**, wherein each set of wares comprises a tray and other wares carried by the tray.

4. A method as claimed in claim **3**, which includes providing a plurality of baskets, each of which is intended to hold at least one complete set of wares, wherein step (1) includes loading each set of wares into a basket, steps (2) and (3) comprise sequentially passing the baskets loaded with sets of wares through a washing and drying means and through a cooling means, and step (4) comprises removing each set of wares from the baskets and returning the baskets for reuse.

5. A method as claimed in claim **4**, wherein each basket is adapted to hold two sets of wares, and wherein step (1) includes loading two sets of wares into each basket and step (4) includes unloading two sets of wares from each basket.

6. A method as claimed in claim **4**, wherein each basket is adapted to hold four sets of wares, and wherein step (1) includes loading four sets of wares into each basket and step (4) includes unloading four sets of wares from each basket and reassembling each set of wares.

7. A method as claimed in claim **4**, wherein each basket includes a first retention means for retaining food containers in position, the first retention means being moveable between open and closed positions, wherein step (1) includes placing the retention means in the open position, loading the basket with food containers and moving the retention means to the closed position and step (4) includes moving the first retention means to the open position and removing the food containers from the basket.

8. A method as claimed in claim **7**, wherein the basket includes slots for trays, food containers and lids, wherein step (1) includes filling the slots with trays and food containers.

9. A method as claimed in claim **8**, wherein the basket includes a lid holding area and second retention means for holding lids in position, the second retention means being movable between open and closed positions, wherein step (1) includes loading the lid holding area with lids with the second retention means in the open position and moving the second retention means into the closed position, and step (4) includes moving the second retention means to the open position and removing the lids from the lid holding area.

10. A method as claimed in claim **9**, wherein each basket includes an insert container for cutlery, wherein step (1) includes loading the insert container with cutlery and step (4) includes removing the cutlery from the insert container.

11. A method as claimed in claim **10**, wherein each basket includes a fixed retention member for retaining open containers, wherein step (1) includes sliding containers under the fixed retention member and step (4) includes sliding the containers out from under the fixed retention member and removing the containers from the basket.

12. A method as claimed in claim **4**, which includes providing a substantially continuous conveyor means, including an input station at one point on the conveyor means and a discharge station at another point on the conveyor means, the washing and drying means and the cooling means being provided along the conveyor means, wherein step (1) comprises receiving sets of soiled wares at the input station, loading soiled wares into baskets at the input station and loading the baskets with the soiled wares onto the conveyor means, whereby the baskets are transported by the conveyor means through the washing and drying means and then through the cooling means, and wherein step (4) comprises receiving the baskets at the discharge station and removing and reassembling the sets of wares from the baskets and then returning the baskets along the conveyor means to the input station.

13. An apparatus for washing soiled wares and providing the wares ready for refilling and reuse, the apparatus comprising:

an input station for receiving soiled wares;

a discharge station for removing clean wares and reassembling wares into sets of wares;

a substantially continuous conveyor means extending between the input station and the discharge station and back from the discharge station to the input station;

a washing and drying means provided on the conveyor means; and

a cooling means provided on the conveyor means, the arrangement being such that baskets containing sets of wares are sequentially subject to washing, drying and cooling between the input and discharge stations.

14. An apparatus as claimed in claim **13**, wherein the washing and drying means comprises a separate washing unit and a separate drying unit.

15. An apparatus as claimed in claim **14**, wherein the input station comprises two input locations on either side of a conveyor.

16. An apparatus as claimed in claim **15**, wherein the conveyor means is adapted to convey baskets, each holding at least one set of wares, wherein the basket and the conveyor means are adapted to permit free flow of water for washing and air for drying.

* * * * *

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[54] METHOD AND APPARATUS FOR WASHING AND DRYING HARVESTED VEGETABLES

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[51] **Int. Cl.**[7] **F26B 5/08**

[52] **U.S. Cl.** **34/312**; 34/322; 34/58; 34/60; 34/209; 34/236

[58] **Field of Search** 34/58, 60, 62, 34/63, 202, 209, 236, 312, 318, 322, 328; 15/3.11, 3.12; 134/25.3, 72, 73, 74, 104.4; 426/302, 489, 506, 532; 99/489, 536, 623

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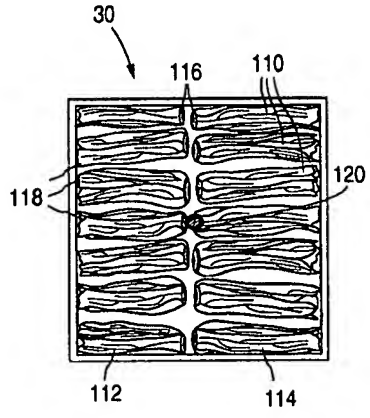
Primary Examiner—Pamela A. Wilson

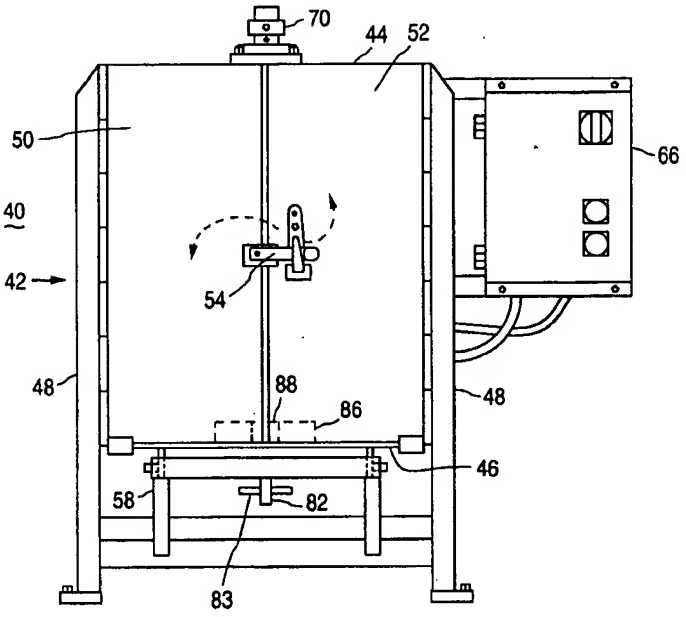
Attorney, Agent, or Firm—J. William Wigert, Jr.; Crosby Heafey Roach & May

[57] **ABSTRACT**

A method and apparatus for processing whole head vegetables, characterized by a core end, and an open leafy end, is disclosed. Whole head vegetables pass through a washer which has a bottom belt which runs through the length of the washing line and passes through a first and a second tank (or more tanks) of cleaning water. Between the first and second cleaning tanks, a plurality of spray bars further clean the whole head vegetables. Top belts at each of the cleaning tanks above the bottom belt to secure the produce as it passes through the first cleaning tank and through the second cleaning tank. The lower belt, and the upper belts are controlled by a single speed control system resulting in less damage to the produce. Additionally, the angle of the belts conveying the produce through the two cleaning tanks is chosen for optimum performance. After the produce is washed, baskets, or totes, filled with the wet produce to be dried, are stacked vertically on a rotatable turntable assembly within an inner support frame. The totes are arranged with the open tops facing upwardly. A worker, to load the totes in the dryer, slides each tote within the inner frame with one on top of the other. The inner support frame has a top and bottom spindles or shafts which are rotationally supported by bearing structures at the top and bottom of the dryer. Moisture is driven out by centrifugal force when the inner support frame/totes are rotated.

17 Claims, 10 Drawing Sheets





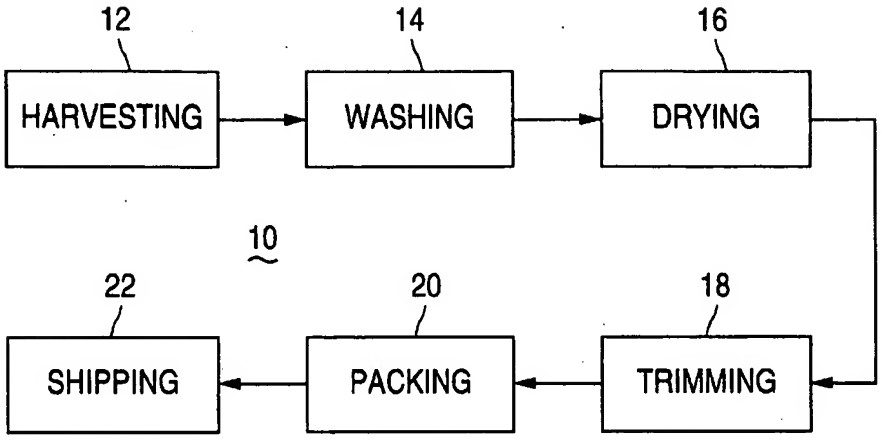


FIG. 1

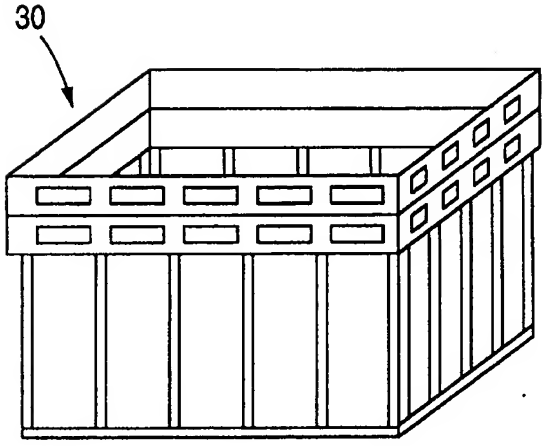


FIG. 2A

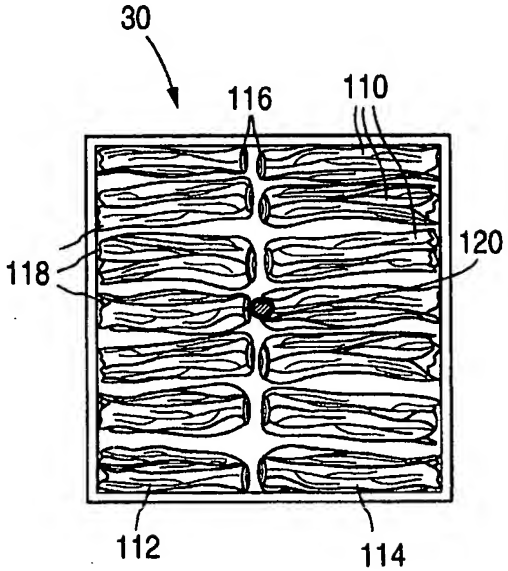


FIG. 2B

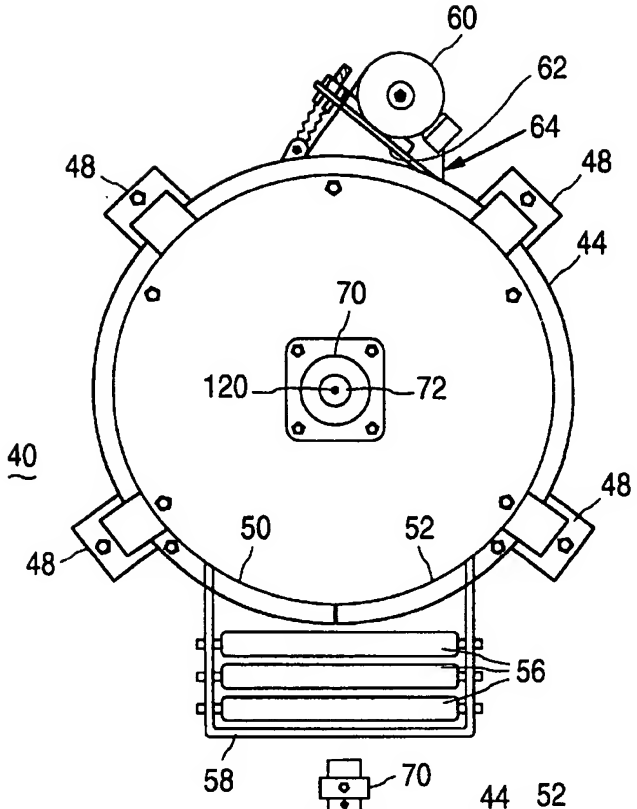

60
62
64
48
48
44
70
120
72
40
48
48
50
52
56
58

FIG. 4

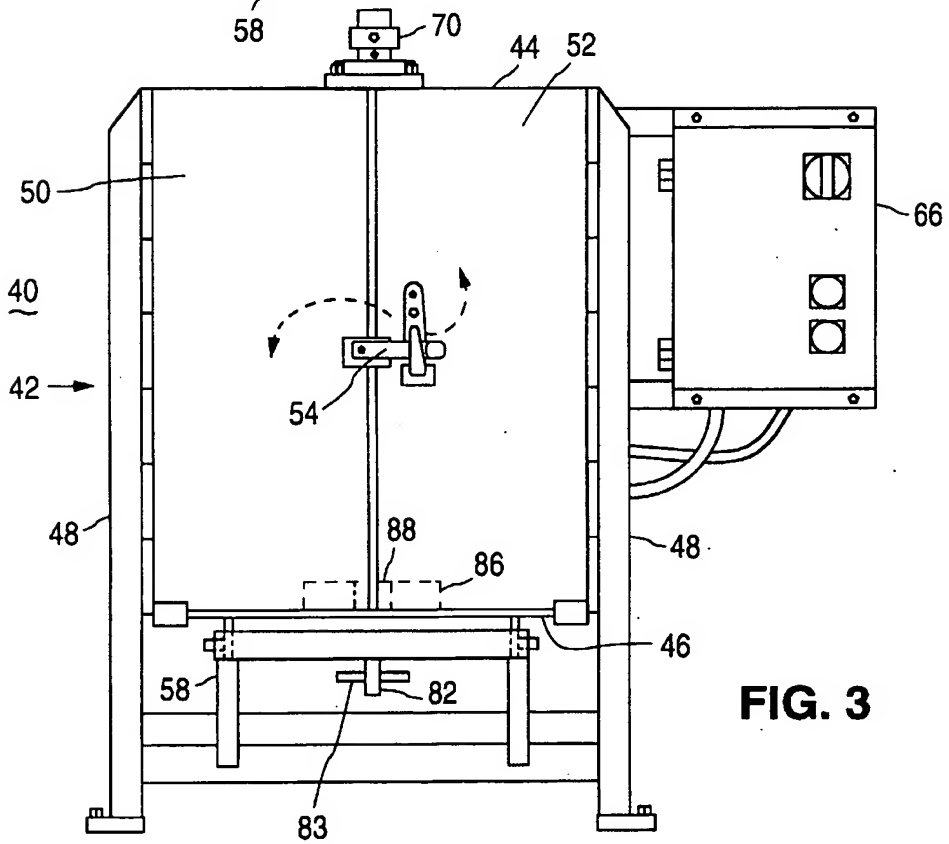

70
44
52
50
66
40
42
54
48
88
86
48
46
58
82
83

FIG. 3

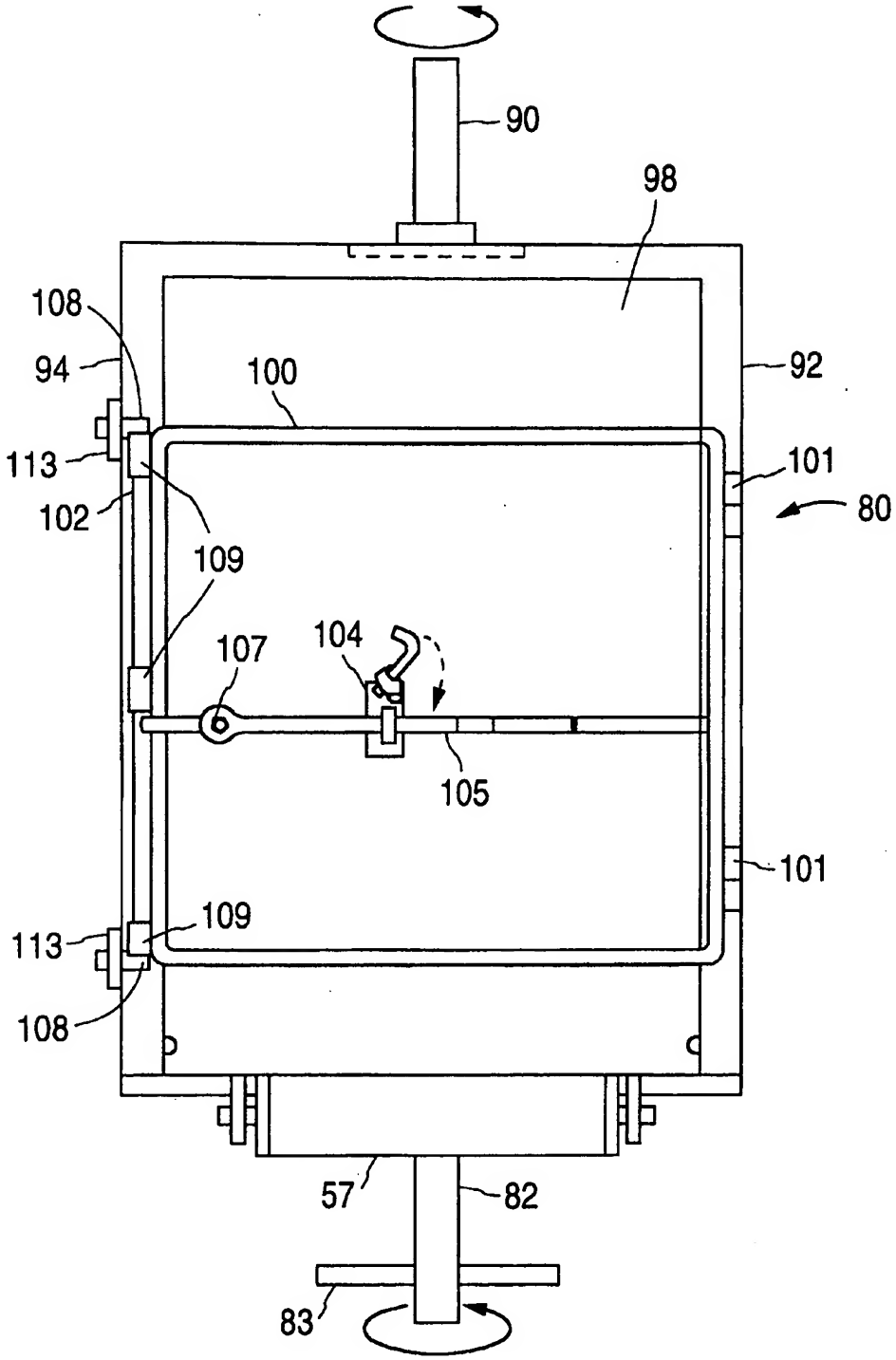

90
98
108
94
100
92
113
101
102
80
109
107
104
105
101
109
113
108
57
82
83

FIG. 5

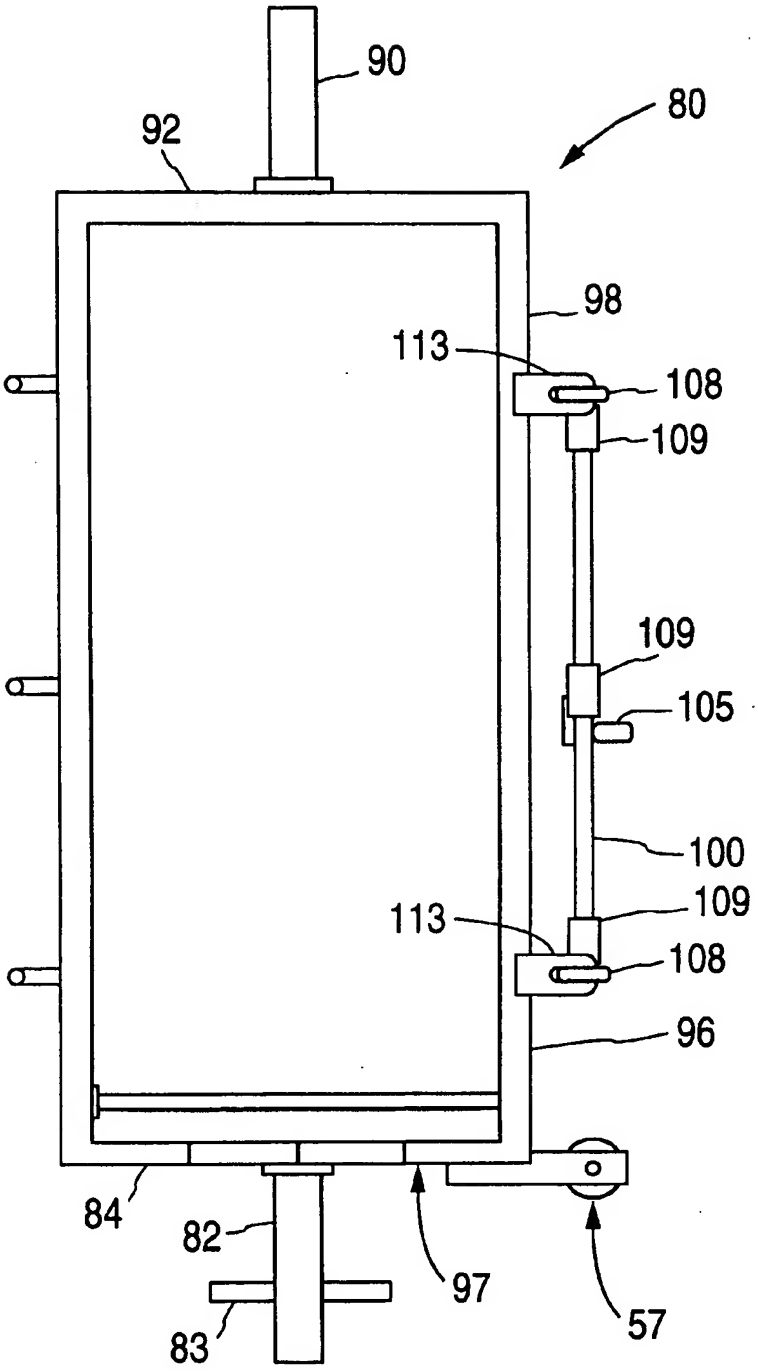


FIG. 6

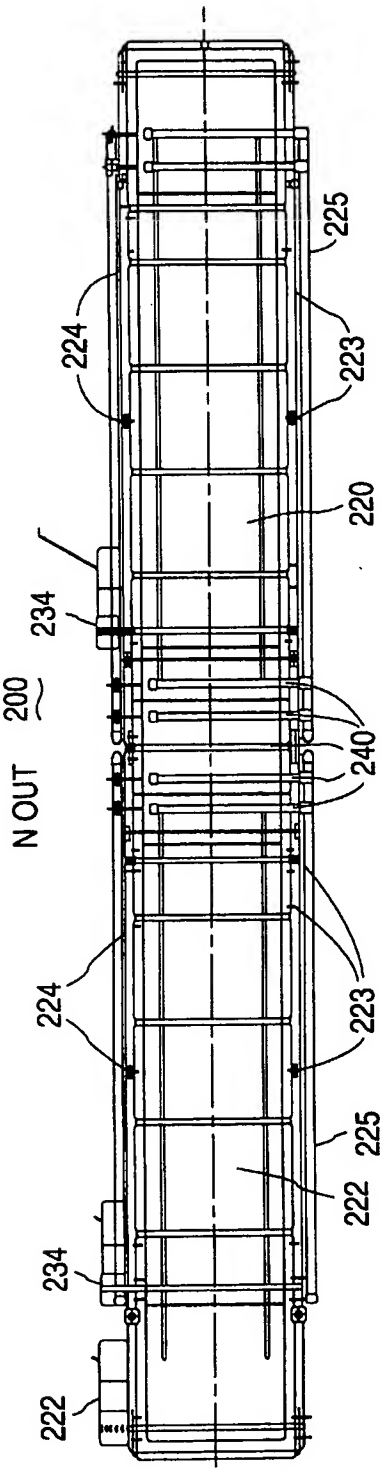

225
224
223
220
234
200
N OUT
240
224
223
225
222
234
222

FIG. 7A

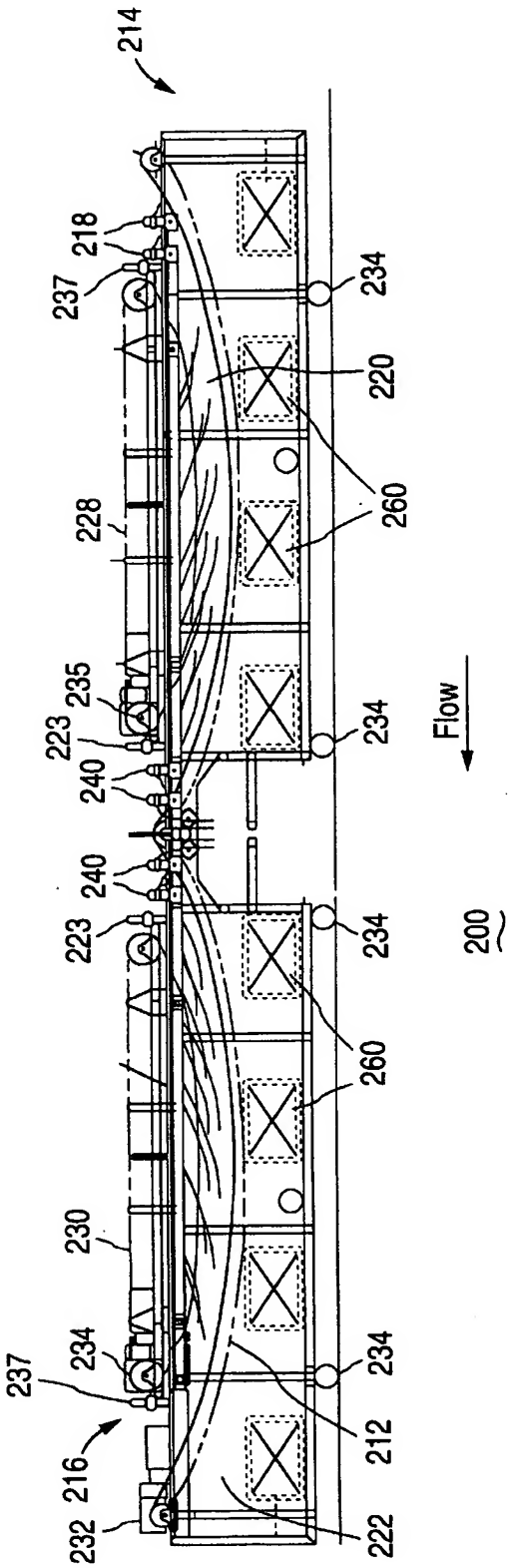

214
218
237
234
220
260
228
235
223
240
234
Flow
240
223
234
200
260
230
234
237
234
216
212
232
222

FIG. 7B

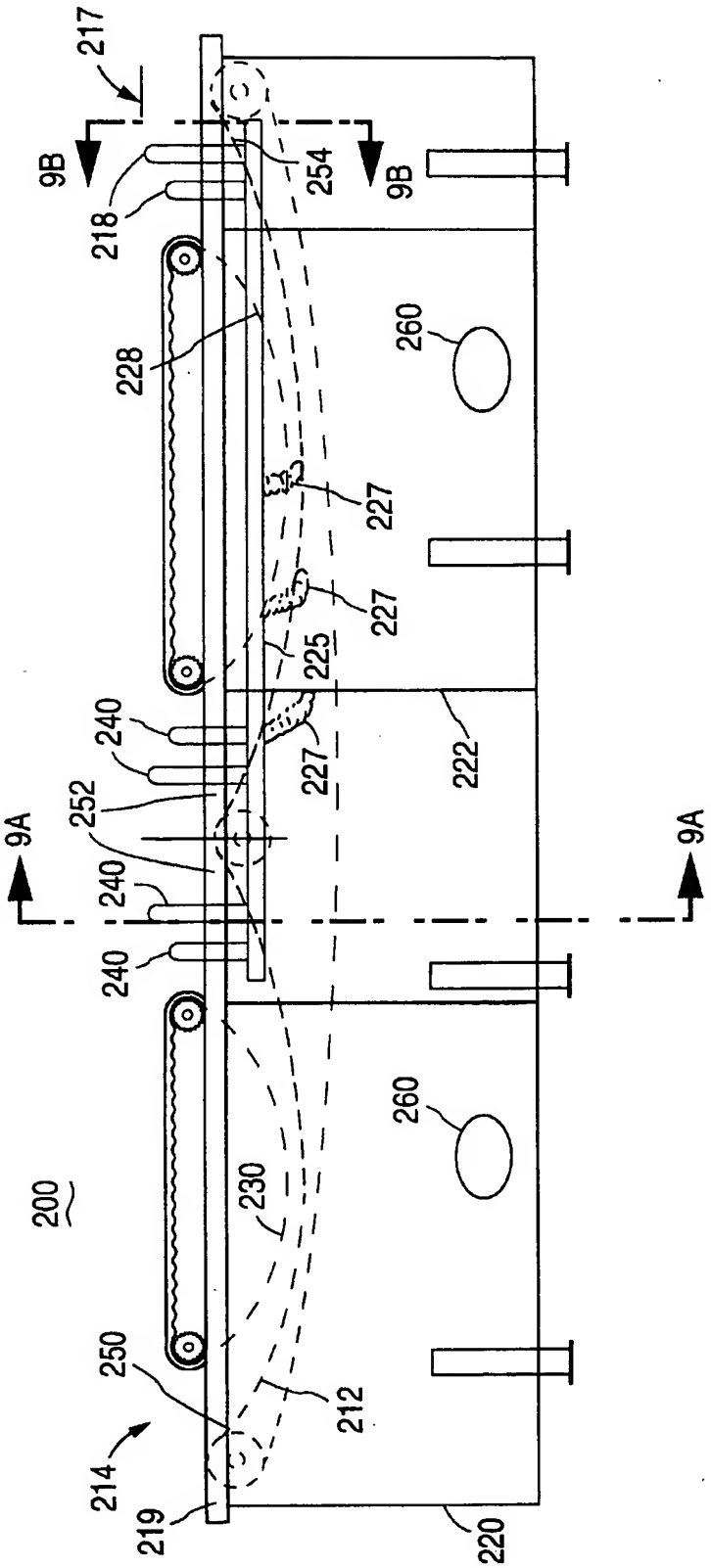

217
9B
9B
218
254
228
260
227
227
225
240
252
240
240
222
9A
9A
200
230
260
250
212
214
219
220

FIG. 8

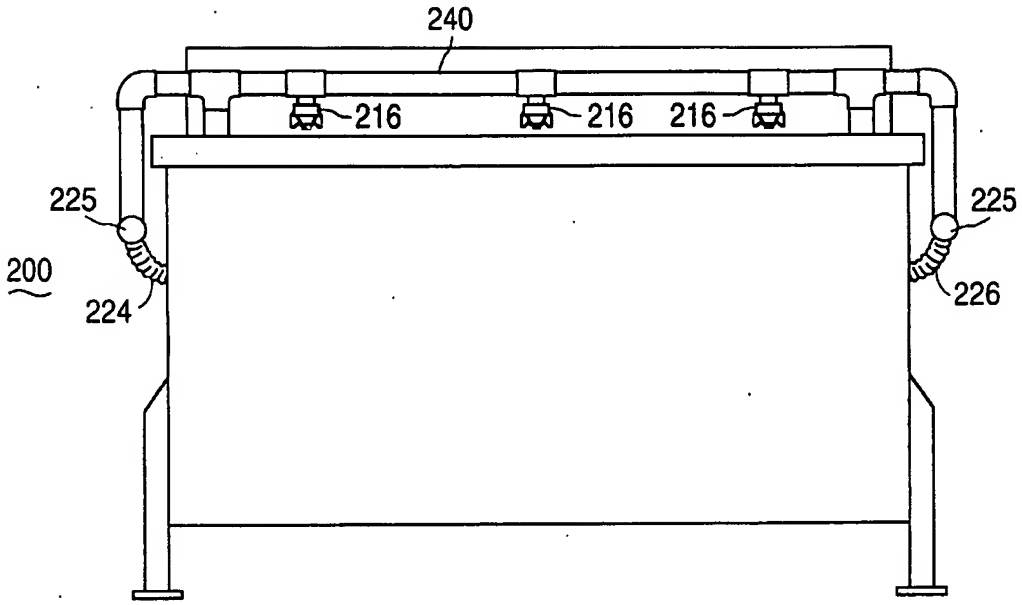


FIG. 9A

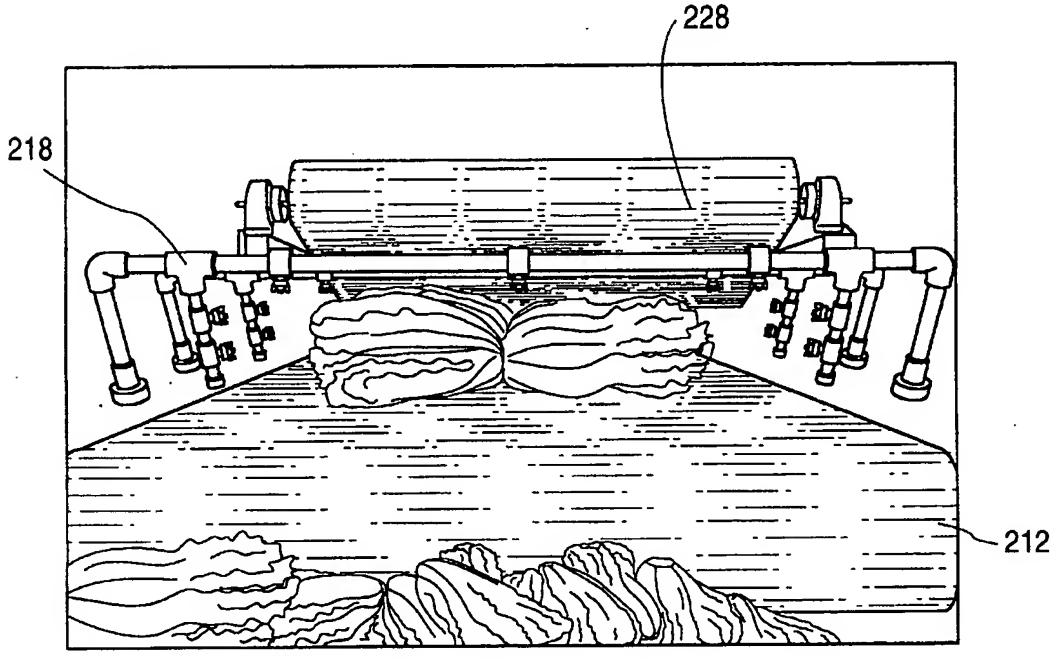


FIG. 9B

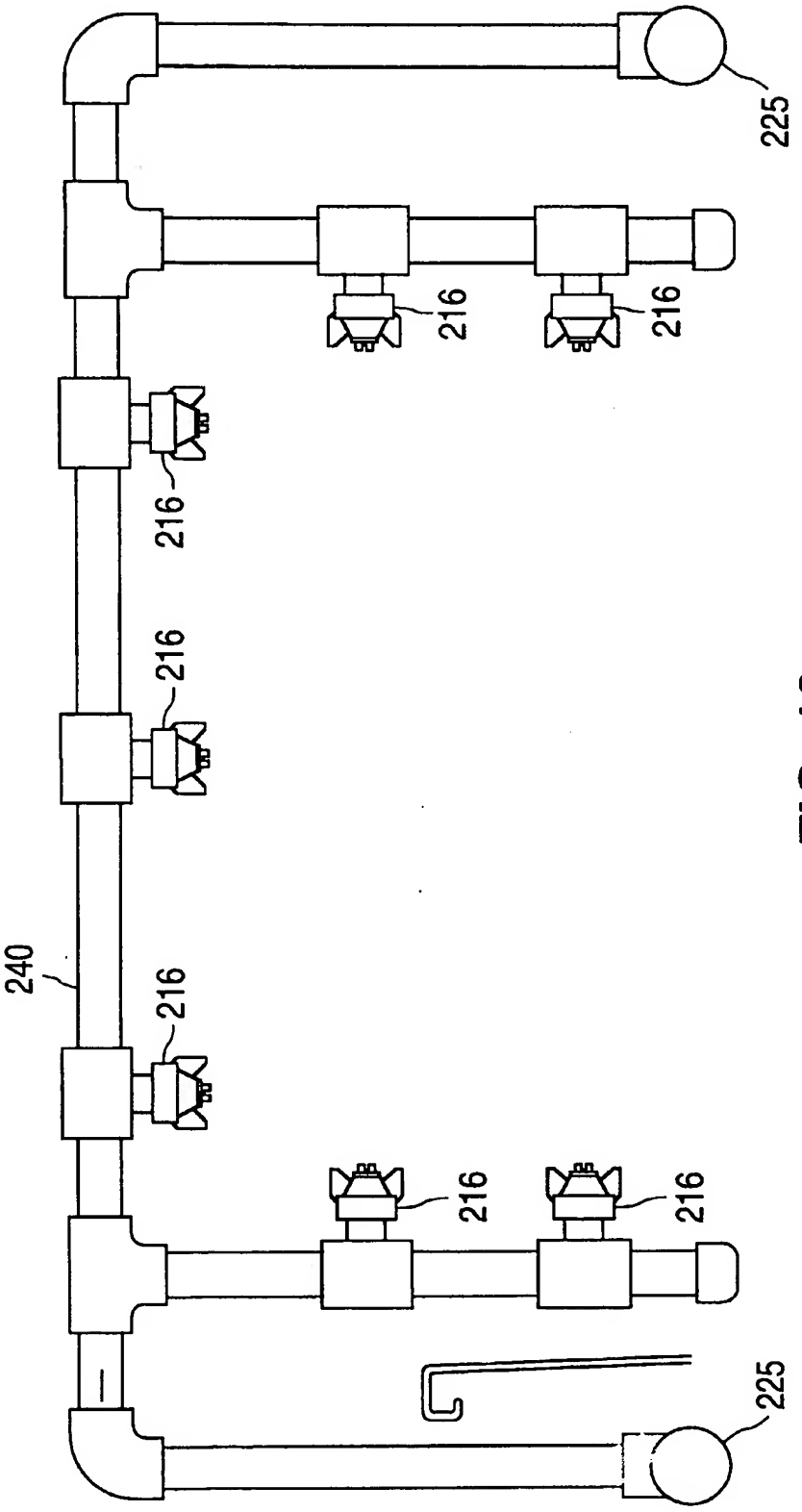


FIG. 10

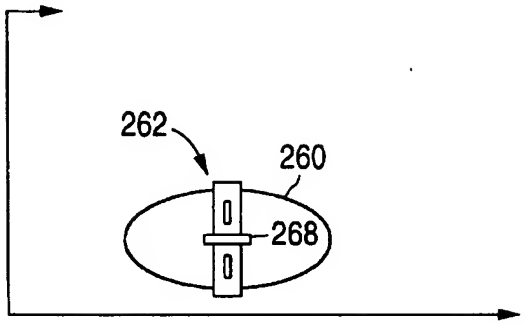


FIG. 11A

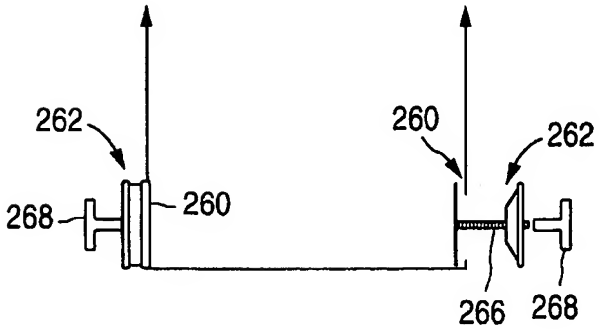


FIG. 11B

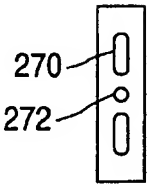


FIG. 11C

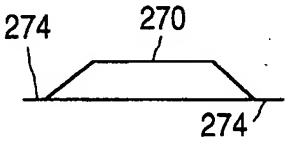


FIG. 11D

FIG. 11E

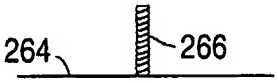


FIG. 11F

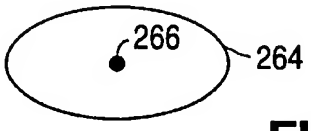


FIG. 11G

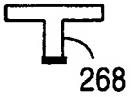


FIG. 11H

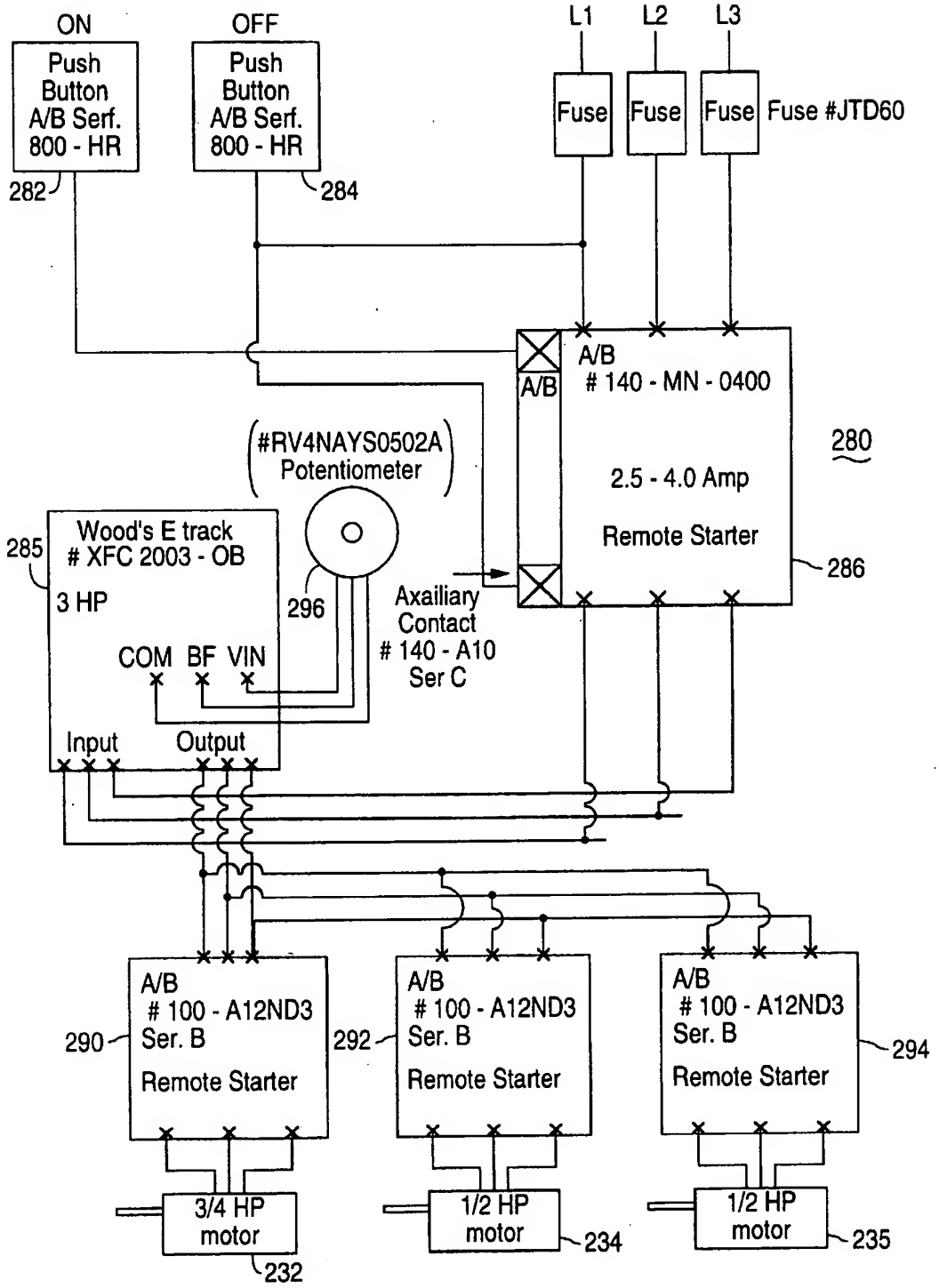

ON
Push Button A/B Serf. 800 - HR
282
OFF
Push Button A/B Serf. 800 - HR
284
L1
L2
L3
Fuse
Fuse
Fuse
Fuse #JTD60
A/B
A/B
140 - MN - 0400
2.5 - 4.0 Amp
Remote Starter
280
286
#RV4NAYS0502A Potentiometer
Wood's E track # XFC 2003 - OB
285
3 HP
296
COM BF VIN
Axailiary Contact # 140 - A10 Ser C
Input
Output
A/B # 100 - A12ND3 Ser. B Remote Starter
290
A/B # 100 - A12ND3 Ser. B Remote Starter
292
A/B # 100 - A12ND3 Ser. B Remote Starter
294
3/4 HP motor
232
1/2 HP motor
234
1/2 HP motor
235

FIG. 12

METHOD AND APPARATUS FOR WASHING AND DRYING HARVESTED VEGETABLES

RELATED APPLICATIONS

This is a continuation-in-part application of co-pending patent application Ser. No. 09/197,342 entitled Improved Dryer For Drying Harvested Vegetables, filed Nov. 20, 1998, now U.S. Pat. No. 5,992,042 assigned to the same assignee as the present application.

FIELD OF THE INVENTION

The present invention relates to washing and processing produce such as lettuce, leafy vegetables and the like, and in particular to whole head vegetables.

RELATED ART

In the field produce such as lettuce, leafy and other vegetables, are harvested both by hand and by mechanized equipment. Produce cut in the field is often put into, transported, and stored in containers or baskets, often referred to as "totes". Typically, theses totes are made of plastic, are constructed to have multiple openings in the sides and bottom, and are open at the top where the produce is put into the tote.

The harvested produce is transported to a production facility where, among other things, the produce is washed, dried, weighed, trimmed, packaged and shipped. During the washing phase produce is typically emptied from the individual totes and washed in bulk. Afterwards, the produce must be dried before the remaining steps. In some drying operations, the produce is dried in bulk. But it is convenient if the produce can be re-introduced into standard totes for drying and subsequent processing.

SUMMARY OF THE INVENTION

In accordance with the present invention, a method and apparatus for processing whole head vegetables, characterized by a core end, and an open leafy end, is set forth. In particular, whole head vegetables pass through a washer which has a bottom belt which runs through the length of the washing line and passes through a first and a second tank of cleaning water. Between the first and second cleaning tanks, a plurality of spray bars further clean the whole head vegetables. Top belts are also provided above the bottom belt to secure the produce as it passes through the first cleaning tank and through the second cleaning tank.

In accordance with another aspect of the invention, the lower belt, and the upper belts are controlled by a single speed control system. Since the belts are thus not individually controlled there is no possibility that there the belts can run at different speeds, which can result in damage to the produce. Additionally, the angle of the belts conveying the produce through the two cleaning tanks is chosen for optimum performance.

The totes are arranged with the open tops facing upwardly. A worker, to load the totes in the dryer, simply slides each tote within the inner frame with one on top of the other. The inner support frame has a top and bottom spindles or shafts which are rotationally supported by bearing structures at the top and bottom of the dryer. Moisture is driven out by centrifugal force when the inner support frame/totes are rotated.

In accordance with another aspect of the invention, a method and apparatus for washing and then drying produce, such as whole head lettuce characterized by having a core or cut end, and an open leafy end, is provided. Such produce is sometimes referred to as whole head lettuce or whole head vegetables. Such produce is normally washed and dried manually rather than mechanically. In accordance with this aspect of the invention, such types of harvested whole head vegetable produce, after being washed, is loaded into one or more individual baskets or totes.

In the preferred embodiment of the invention, one or more totes are filled with produce having a cut end and an open, leafy end after washing. Preferably a plurality of totes are stacked and secured in a rotatable manner within a mechanical dryer. The stack of totes, which are rectangular in shape, are centered on or near the rotational axis within an inner frame or framework. The frame is provided with top and bottom spindle shafts which are supported in bearing supports. The inner frame is rotated so that moisture in the produce is centrifugally forced out of the produce.

In the preferred embodiment, produce such as whole head vegetables are arranged in a preferred manner in the totes for the drying operation. Specifically, rows of produce are arranged in the totes with the cores or cut ends of a row of produce juxta positioned with, or "butted" against, the cut ends of another row, with the leafy ends generally pointing away from the axis of rotation. In this position, water or moisture tends to flow outwardly from the leafy open ends when the inner frame is rotated.

The foregoing and other objectives, features and advantages of the invention will be more readily understood upon consideration of the following detailed description of certain preferred embodiments of the invention, taken in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a flow chart for processing harvested produce such as lettuce and other leafy vegetables.

FIG. **2A** is a perspective view of a standard basket or tote used to transfer harvested vegetables and FIG. **2B** is a top view of a tote loaded with a vegetable such as whole head vegetables.

FIG. **3** is a front elevation view of a dryer in accordance with the present invention.

FIG. **4** is a top view of the dryer of FIG. **3**.

FIG. **5** is a front elevation view of the inner frame of the dryer of FIG. **3**.

FIG. **6** is a side view of the inner frame of FIG. **5**.

FIG. **7A** is a top view, and FIG. **7B** is a side view of the improved produce washing machine of the present invention.

FIG. **8** is a simplified side view of the washer of FIG. **7C**.

FIG. **9A** and FIG. **9B** are cross sectional views of the washer of FIG. **8**.

FIG. **10** is a detailed diagram of one of the plurality of spray bars.

FIG. **11A** is a front view and FIG. **11B** is an end view of a cleaning tank showing cleaning ports; FIG. **11C**, FIG. **11D** and FIG. **11E** are top, side and end views respectively, of the bracket of the door mechanism of the present invention; FIGS. **11F** and **11G** are side and top views, respectively, of the sealing plate of the door mechanism; and FIG. **11H** is a plan view of the door mechanism handle.

FIG. **12** is a block schematic diagram of the conveyer speed control system of the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

FIG. **1** is a flow diagram **10** for processing harvested produce such as lettuces, leafy vegetables, whole head and

other vegetables, which will sometimes, collectively be referred to as "produce". By "leafy vegetables" it is meant that family of specialty lettuces and other leafy greens which, when mixed together for sale and consumption are sometimes referred to as "spring mix," "mixed greens," or "baby greens." For example, this includes lettuces, such as green romaine, red romaine, sierra, lola rosa, tango, green leaf, red leaf, little gem, red butter, read oak, red perella and green perella. It also includes greens such as arugula, mizuna, red mustard, green mustard, spinach, tatsoi, red chard and red russian kale.

After the produce is harvested, as indicated at **12**, the produce is sent to a plant for processing. This is typically accomplished by transporting the produce in standard baskets frequently referred to as "totes". FIG. **2A** is a perspective view of a standard basket or tote **30** used to transfer harvested vegetables and FIG. **2B** is a top view of a tote loaded with vegetables, such as whole head vegetables, as an example. In the plant the produce is either processed or cooled in a vacuum tunnel and then stored for a short period of time, up to two days.

The produce is then unpacked from the totes and washed in a produce washing machine. The next step **16** is to dry the moist produce. As explained above, some drying machines dry the produce in bulk, while others, such as that shown in U.S. Pat. No. 5,675,905, dry the produce while the produce is stored in totes. Mechanically washing some kinds of vegetables, such as whole head lettuce and other vegetables is difficult to dry mechanically. After drying, the totes are delivered to stations for trimming, if necessary, as indicated at **18**. Any damaged or broken leaves are also removed. For whole head products the core is removed or trimmed. After weighing, the trimmed produce is then packed as indicated at **20**. Produce is frequently packed in plastic bags or in cardboard boxes. At this point the produce is ready for shipment, as indicated at **22**.

FIG. **3** is a front elevation view, and FIG. **4** is a top view, of a dryer **40** in accordance with the present invention. The dryer **40** has an outer body **42** having a top **44** and a bottom **46**. Body **42** is supported by legs **48**. A pair of doors **50** and **52** close an opening in the front of outer body **42**. The doors are provided with a suitable latching mechanism **54**. The doors are open when the dryer is being loaded and closed during a drying operation. A plurality of first rollers **56** are mounted by a bracket **58** to the dryer **40**. Rollers **56** facilitate the loading of dryer **40** with a stack of totes **30**.

Rotation of the produce-carrying totes **30** is accomplished by the use of a motor **60** attached by a support structure **62** to dryer **40**. The motor is provided with a coupling device, such as a V-belt, or preferably, a cleated belt **64**. The motor drives rotates the inner body **80** (FIGS. **5** and **6**) and the enclosed totes **30**. This is accomplished by coupling the cleated belt **64** to a pulley **83** attached to the lower spindle shaft **82** (FIGS. **5** and **6**).

A control panel **66** is provided for controlling the operation of dryer **40**. A conventional inverter and timer are provided within the control panel **66** to control the duration and revolutions per minute. It is important that the dryer dry the produce thoroughly by turning at an adequate speed, for an adequate period of time, while preventing excess mechanical damage from drying the produce too vigorously. The duration, and speeds of rotation must be empirically determined for each type of produce being dried.

A spindle shaft support **70** is provided at the top of outer body **42**. A bearing **72** is provided as a part of support **70**. As will be explained below, support **70** anchors and permits rotation of the inner frame containing the totes.

FIG. **5** is a front elevation, and FIG. **6** is a side view of the inner frame **80** of the dryer of FIG. **3**. Inner frame **80** both supports and secures a stack of totes filled with produce during the drying operation. A lower spindle shaft **82** is connected to the bottom **84** of the inner frame. Spindle shaft **82** is supported by spindle support structure **86** having a central bearing **88** (FIG. **3**). An upper spindle shaft **90** is attached to the top **92** of inner frame **80**. The shaft **90** is rotationally supported by spindle shaft support **70** and bearing **72** (FIGS. **3** and **4**) on dryer body **42**. A second roller assembly **57** is connected to the inner frame **80** and is aligned with the first roller **56** assembly to facilitate the placement of totes within the inner frame. Rollers **56** and **57**, in one actual embodiment, have a 2 ½ inch diameter and are made of stainless steel.

Inner frame **80** has three sides **92**, **94** and **96** and a front opening **98** through which the totes **30** are inserted. It also has a bottom **97** which supports the totes. Bottom **97** is made of ½ inch plate steel, in one actual embodiment. While the totes, preferably, are first stacked and then inserted within inner frame **80**, they can be inserted and stacked individually. A door **100** is rotatably attached to the inner frame by a hinge assembly **101**. When the door is closed, it completes the enclosure of the stack of totes.

The inner door latching mechanism operates as follows. To open the door, a latch **104** is pivoted upwardly. This allows the operator to pivot lever **105** upwardly about pivot hinge **107**. Vertical shaft **102** is held in place by three guide sleeves and is terminated at each end by hooks **108** which, when the door is closed, are engaged by securing eyes **113**. When the operator rotates vertical shaft **102** about its axis this unhooks hooks **108** from securing eyes **113**. In this position the door may be opened, pivoting about the hinge **101**. The process is reversed to close and secure door **100**.

The inner frame preferably is made of stainless steel. In one embodiment the frame is formed by 1 ¼ inch channels and the door is formed by ½ inch diameter tubing. The outer body **42** is made of stainless steel sheet metal.

Referring to FIG. **2B**, it has been found that when drying whole head vegetables **110**, there is a preferred way to place them in the totes **30**. First and second rows **112** and **114** are formed with the cut or core ends **116** generally abutted or juxta positioned to each other with the leafy ends **119** facing outwardly, relative to the axis of rotation **120**. Of course, the totes **30** are filled in layers of rows to fill them. It should also be understood that filling the totes in an actual production facility does not require a high degree of precision so there is no requirement that individual heads precisely abut each other.

Referring to FIGS. **7A** and **7B**, FIG. **8** and FIG. **9**, an improved washing machine **200** for washing produce, including whole head vegetables as shown. While any type of produce can be washed with the improved washer and method of the present invention, for purposes of this description, washing and drying of whole head vegetables will be described. As explained the whole head vegetables, after being harvested, are shipped to the plant first to be washed. The whole head vegetables are unpacked from the totes and loaded, in one to four rows, on an intralox type dewatering or lower belt **212** at the entry end **214** of the washing machine **200**. Note the entry end of the washer **200** in FIGS. **7A** and **7B** is opposite to that in FIG. **8**.

When placed on the dewatering belt, the produce, or product, is oriented with the core facing the centerline of the lower belt as shown in FIG. **9B**. With this orientation the open ends of the whole head vegetables face cleaning jets

216 on a pair of entry spray bars 218. The dewatering belt 212 then runs down into and through the first of two water filled cleaning tanks 220 and 222 having a horizontal surface 219. The first tank 220 is cooled by the addition of chilled water to a temperature of 35–50 degrees F. The second tank 222 is cooled, by recirculating the water through a chiller (not shown), at a temperature of 33–40 degrees F. This differential avoids causing thermal shock in the product by cooling it gradually. Desirably, the cleaning tanks are made of stainless steel. For convenience the tanks may be mounted on casters 234. Access to the inside of the tanks 220 and 222 is through ports 260 as described later.

When the produce passes on lower belt 212 through the cleaning tanks 220 and 222, the produce is cleaned by turbulence caused by two rows of water jets 223 and 224 along each side of each tank which spray inwardly. One row is oriented slightly above the belt 212 and the other slightly below, while both are aimed at the center line of the product as it travels by. A pipe manifold 225 passes water via flexible tubing 227 to the water jets 223 and 224.

The produce is prevented from floating or "bobbing" in the water while submerged by means of a first dewatering top belt 228 and a second dewatering top belt 230. Each top belt 228 and 230 runs the length of one cleaning tanks 220 and 222, respectively, above or at the water level. The height of the belts is adjustable. Posts 237 are threaded, and by adjusting their position, adjusts the frame 1 to the belt. This is to accommodate different size products. The product then exits the first tank 220 at the end of its run as the bottom belt 212 travels up and over the lip of the first tank 220 and down into and through the second tank 222. It should be understood, however, that more than two cleaning tanks may be utilized as required.

The lower belt is driven by a ¾ horsepower motor 232 and each of the upper belts is driven by /2 horsepower motors 234. These motors are under the control of the speed control system of the present invention as explained in connection with FIG. 12.

In accordance with the present invention, between the two tanks 220 and 222 is a plurality of additional spray bars 240. Each spray bar 240 is provided with a plurality of quick tee jets 216. See, in particular FIGS. 9A, 9B and 10. The spray bars can be made from ¾ in. PVC. Cold water is provided via manifold 225 by a re-circulatory motor (not shown). With jets 226 positioned above and along side of the produce, there is sufficient coverage to rinse the produce from above, and from the side, and to penetrate the head of the vegetable. Afterwards, the product moves into the second tank 222. The second upper belt 230 keeps the product under the water, while it is cleaned by a duplicate jet system as in the first tank 220. The whole head product is then picked from the belt at its terminus 216 and loaded back into totes where it is delivered to dryer 40 described above.

Water is pumped into the cleaning tanks by pumps (not shown). It has been found that the use of a mesh screen at the inlet of the recirculating pump prevents stray leaves from being sucked in. The screen must be wide enough to span the width of the tank. It can be hinged to allow pivoting for cleaning.

Important to successful washing of the produce is to maintain the angle of the lower de-watering belt at optimum angles. If the angle is too shallow the product is not effectively washed. If the angles are too steep, the product will "skid" on the way into each cleaning tank and may not be able to "climb" back out. The angles also depend upon the product being washed. For example of a hearts line, a small line, the ideal entry angle (relative to horizonal surface 229 is −20 degrees at the start 250, −18 degrees at the middle 252, and −20 degrees at the finish 254. For a big line for larger products, the angles are −27 degrees at the start, −25 degrees in the middle, and −27 degrees at the finish.

Referring to FIGS. 11A–11C, in accordance with another aspect of the invention, clean out ports 260 are provided for cleaning tanks 220 and 222, as shown in FIG. 8 and FIG. 11A–FIG. 11C. When the door assembly 262 is opened a hose can be inserted within the cleaning tanks and any debris can be removed. Normally, this is done on a daily basis.

Any number of clean out ports can be provided. In FIG. 11B two ports 260 are shown, with the door assembly on the left shown in the sealed or closed state. The door assembly 262 on the right is shown in an exploded view. FIGS. 11C–11H shows the door assembly in greater detail. Port 260 is sealed by an elliptically shaped sealing plate 264 which is larger than the port 260 and fits within the cleaning tank. Affixed perpendicularly to the sealing plate is a threaded rod 266, which in the preferred embodiment has a ⅝ in. thread. A T-shaped handle 268 is female threaded to engage the threaded rod 266.

A bracket 270 is provided with a hole 272 in its center through which passes the threaded rod 266. Bracket 270 is channel shaped as seen in FIG. 11E. It also is provided with lips 274 which engage the edge of port 260 when the handle is screwed down. Bracket 270 serves to provide tension when the handle is screwed down to seal the door. The water in the cleaning tanks must be removed before the doors 262 can be opened because water pressure on plate 264 seals the door tight.

FIG. 12 is a block schematic diagram 280 of the synchronized speed control for the motor 232 which drives the lower belt 212 and motors 234 and 235 which control upper belts 228 and 230. The operator controls an "ON" button 282 and an "OFF" button 284. Note that all of the components in FIG. 12 are commercially available and the part numbers are identified. "A/B" indicates an Allen-Bradley part. Three-phase power lines L1, L2, L3 bring power to a remote starter 286 which converts the 3-phase power to DC. An inverter changes the frequency of the power to the individual motors via individual remote starters 232, 234 and 236. The operator sets the speed of the motors/belts by adjusting potentiometer. With this system all of the belts travel at the same speed.

Although the present invention has been shown and described with respect to preferred embodiments, various changes and modifications are deemed to lie within the spirit and scope of the invention as claimed. The corresponding structures, materials, acts, and equivalents of all means or step plus function elements in the claims which follow are intended to include any structure, material, or acts for performing the functions in combination with other claimed elements as specifically claimed.

What is claimed is:

1. A method of processing whole head vegetables characterized by a core end, and an open leafy end, comprising the steps of:

washing the whole head vegetables;

loading the washed whole head vegetables into a plurality of individual totes;

stacking the plurality of individual totes loaded with the whole head vegetables within an enclosure; and

rotating the enclosure about a rotational axis passing through the stacked totes so that moisture is centrifugally forced out of the whole head vegetables.

2. A method as in claim 1 including the step of arranging the whole head vegetables in two rows within each tote and generally abutting the core ends with the open ends oriented away from the axis of rotation.

3. An apparatus for processing harvested vegetables including whole head vegetables characterized by a core end, and an open leafy end, comprising the steps of:

a washer for washing the whole head vegetables;

a plurality of totes for transporting washed whole head vegetables;

a dryer having an enclosure for holding a stack totes filled with washed vegetables;

means for rotating the enclosure about a rotational axis passing through the stacked totes so that moisture is centrifugally forced out of the whole head vegetables, and

wherein the whole head vegetables are arranged in two rows within each tote of the stacked totes, with the core end of each of the vegetables generally abutting and with the open ends oriented away from the axis of rotation.

4. A method for processing harvested produce characterized by a core end, and an open leafy end, comprising:

passing whole head vegetables through a washer which has a bottom belt which passes through a first and a second tanks of cleaning water;

further cleaning the whole head vegetables by spraying the vegetables with water from jets mounted on a plurality of spray bars when the produce is between the first and second cleaning tanks; and

securing the produce as it passes through the first and second cleaning tanks between the top belts and bottom belt at each of the cleaning tanks.

5. The method of claim 4 including the step of controlling the speed of the lower belt, and the upper belts, by a single speed control system.

6. The method of claim 4 including the additional step of choosing the angle of the lower belt conveying the produce through the cleaning tanks for optimum performance.

7. An apparatus for processing harvested vegetables including whole head vegetables, characterized by a core end, and an open leafy end, comprising:

a lower belt for conveying harvested vegetables through at least first and a second tanks of cleaning water;

a plurality of spray bars to further clean the harvested vegetables by spraying the vegetables with water from jets mounted thereon, when the vegetables pass between the first and second cleaning tanks; and

top belts at each of the cleaning tanks above the bottom belt to secure the vegetables on the lower conveyer belt as they pass through the first cleaning tank and through the second cleaning tank.

8. The apparatus of claim 7 including means for controlling the speed of the lower belt, and the top belts, by a single speed control system.

9. The apparatus of claim 7 wherein the lower belt enters the first cleaning tank at an angle of between about −20 degrees to about −27 degrees relative to horizontal.

10. The apparatus of claim 7 wherein the lower belt exits the first cleaning tank and enters the second cleaning tank at an angle of about −20 degrees to about −25 degrees relative to horizontal.

11. The apparatus of claim 7 wherein the lower belt exits the second tank at an angle of about −20 degrees to about −27 degrees relative to horizontal.

12. The apparatus of claim 7 wherein each of the cleaning tanks is provided with at least one clean out port.

13. The apparatus of claim 12 wherein the at least one cleanout port is provided with a door latch mechanism.

14. The apparatus of claim 7 including a centrifugal dryer for drying the washed vegetables.

15. The apparatus of claim 7 wherein the centrifugal dryer dries vegetables which are stored in totes comprising:

an outer dryer body having a top and bottom, an outer body opening, a door for enclosing the outer body opening during the operation of the dryer, and top and bottom spindle supports located in the top and bottom of the dryer body;

an inner frame having an opening which can be aligned with the outer body opening so that a plurality of totes can be placed and stacked within the inner frame;

spindle shafts attached at the top and bottom of the inner frame which define an axis of rotation and which are rotatably supported by the top and bottom spindle supports, respectively;

a motor for rotating the inner frame about the rotational axis during operation of the dryer; and

a door for closing the opening in the inner frame after the totes have been stacked within the frame.

16. A centrifugal dryer as in claim 15 wherein the totes are rectangular in shape and the inner frame is also rectangular and and a stack of totes which conforms to the shape of the inner frame.

17. A centrifugal dryer as in claim 15 wherein the vegetables are whole head vegetables having cut ends and leafy ends which are placed within the totes in rows wherein the cut ends are generally adjacent to each other and the leafy ends extend outwardly in a direction generally away from the axis of rotation.

* * * * *

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Tarantino et al. (43) Pub. Date: Sep. 30, 2004

(54) LETTUCE AND ROMAINE HARVESTING MACHINE AND METHOD

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(21) Appl. No.: 10/812,571

(22) Filed: Mar. 29, 2004

Related U.S. Application Data

(62) Division of application No. 10/691,394, filed on Oct. 21, 2003.

(60) Provisional application No. 60/444,729, filed on Feb. 3, 2003.

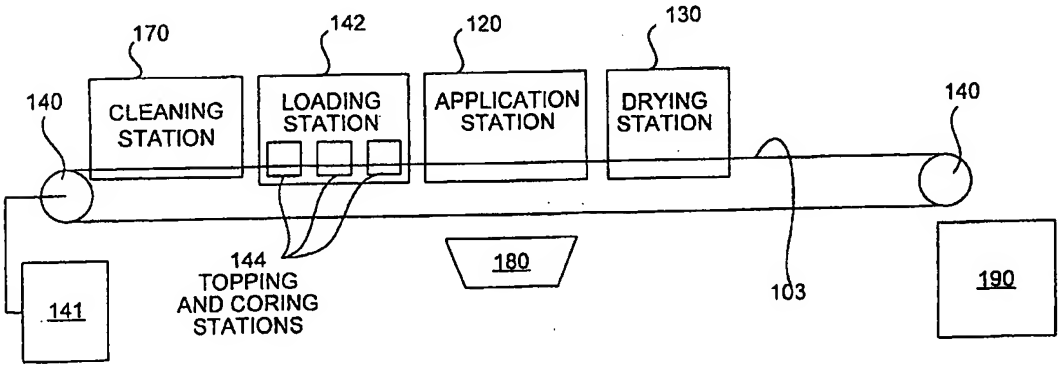
Publication Classification

(51) Int. Cl.[7] A01D 34/00

(52) U.S. Cl. 56/327.1

(57) ABSTRACT

A produce harvesting apparatus of the invention includes a conveyor system having conveyor belt driven over rollers by a drive element. The belt includes cushioned produce holders suitable for maintaining produce products in a desired orientation on the belt during operation. The apparatus includes a coring station suitable for coring harvested lettuce. The apparatus includes a loading station wherein the cored lettuce is loaded onto the cushioned produce holders and carried to an application station where shelf life extending materials are applied to the cut portions of the lettuce. The processed lettuce then proceeds to an unloading station where it is removed from the conveyor belt. Other inventive aspects include the conveyor belt having cushioned produce holders and the coring station as well as methods of implementing the disclosed devices.



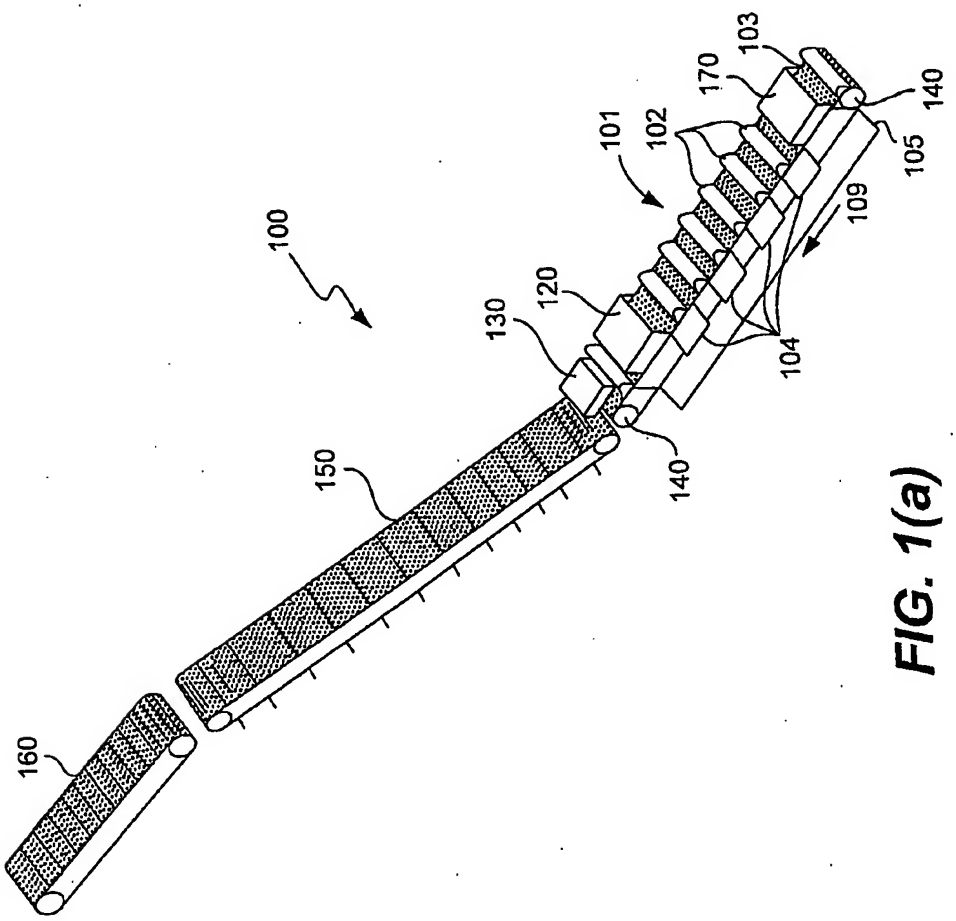


FIG. 1(a)

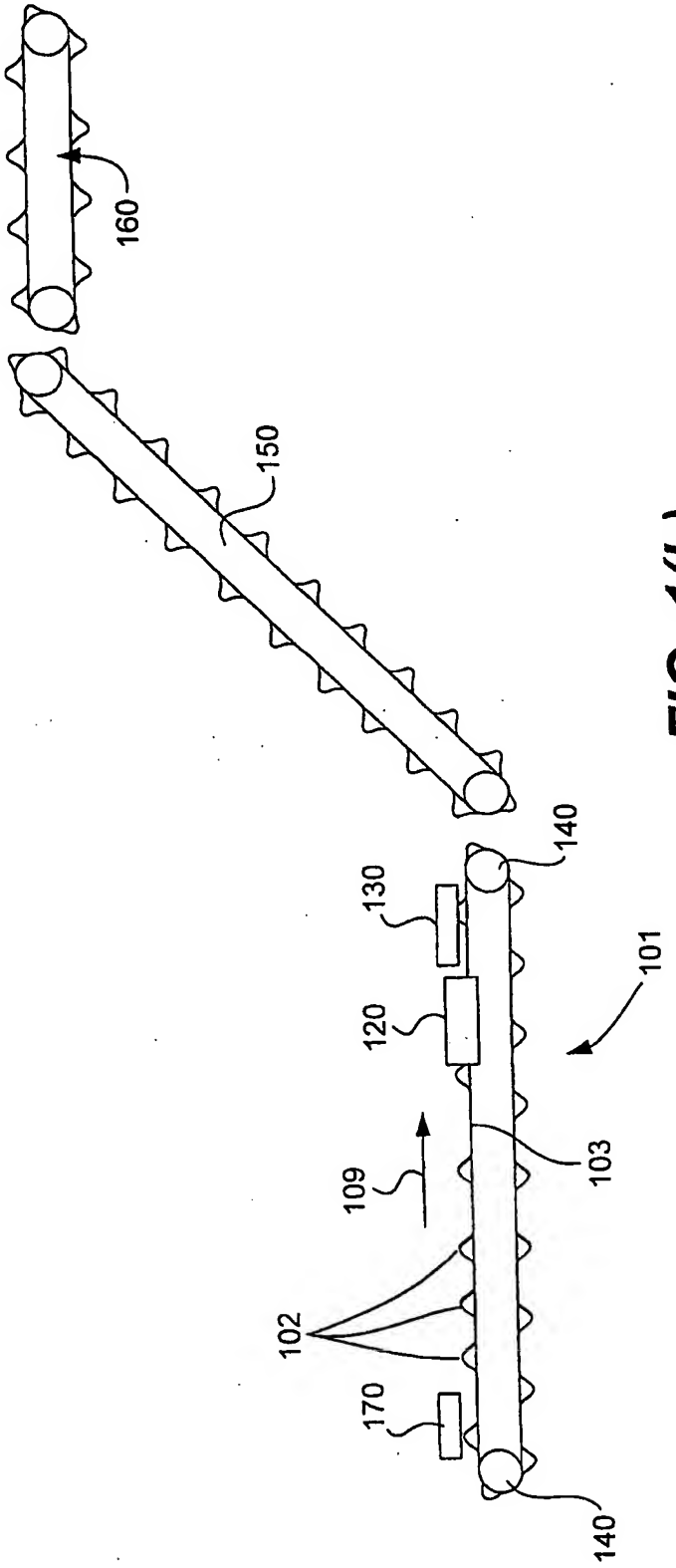


FIG. 1(b)

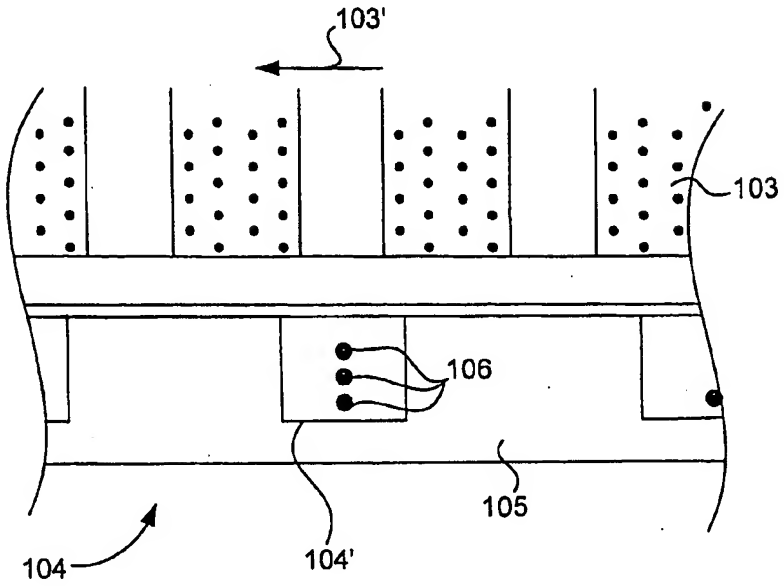


FIG. 2(a)

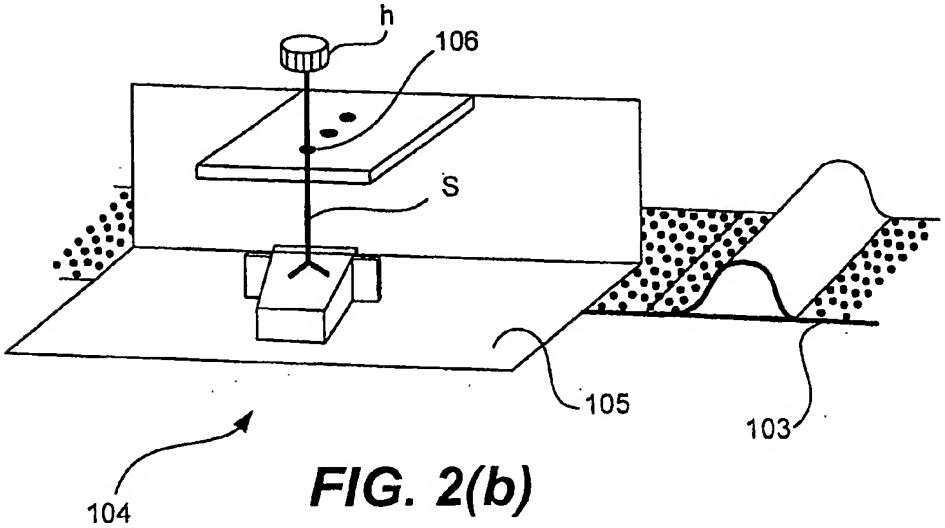


FIG. 2(b)

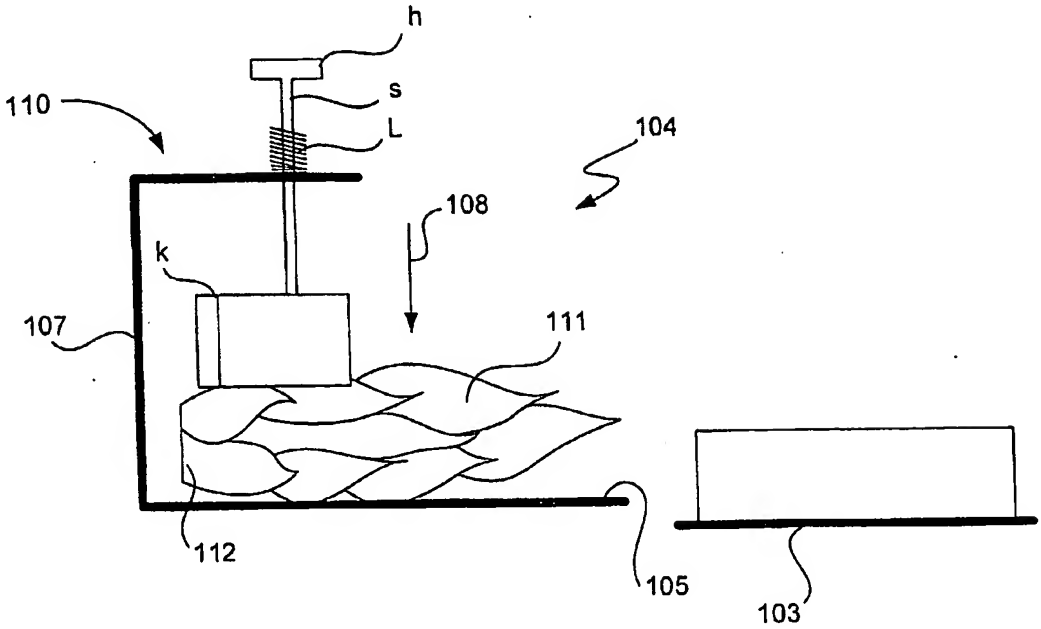


FIG. 2(c)

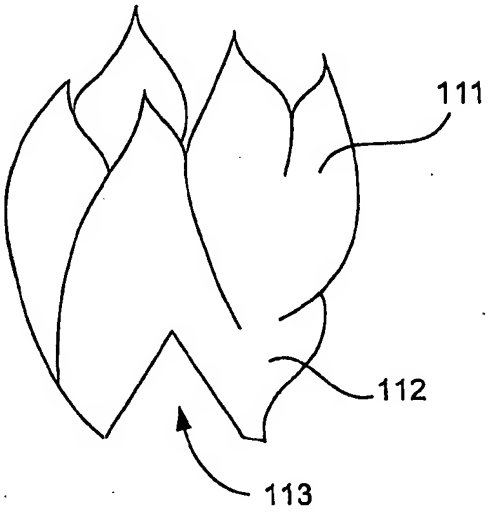


FIG. 2(d)

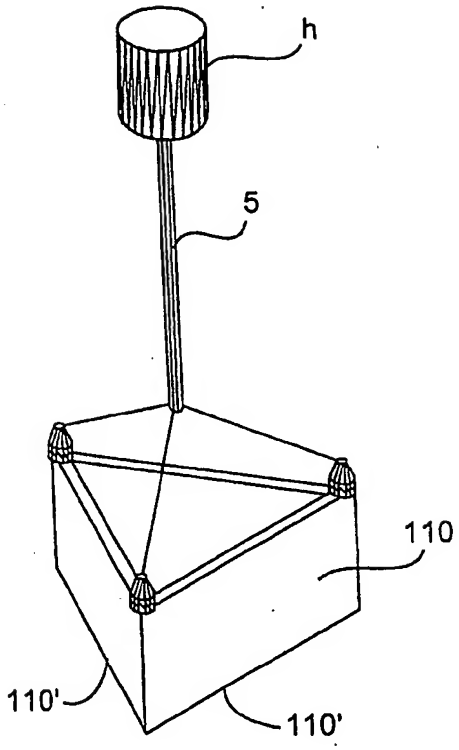


FIG. 2(e)

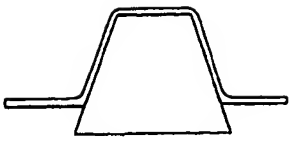
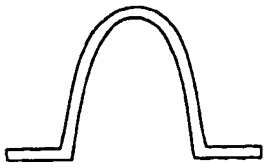


FIG. 2(f)



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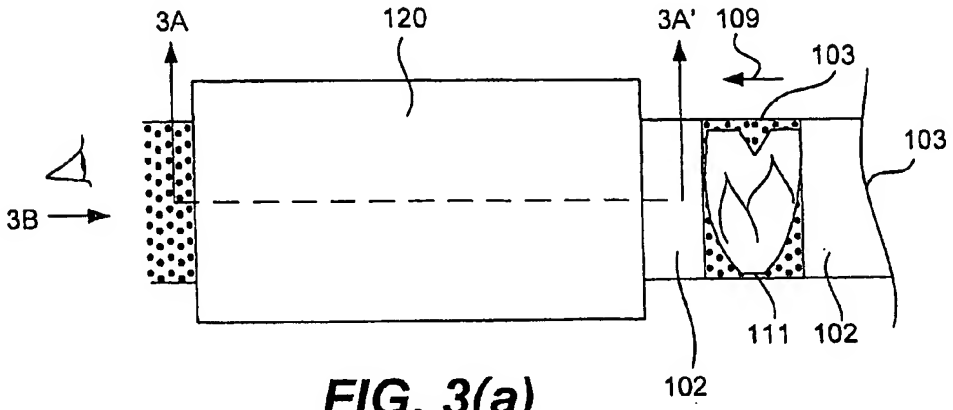

FIG. 3(a)

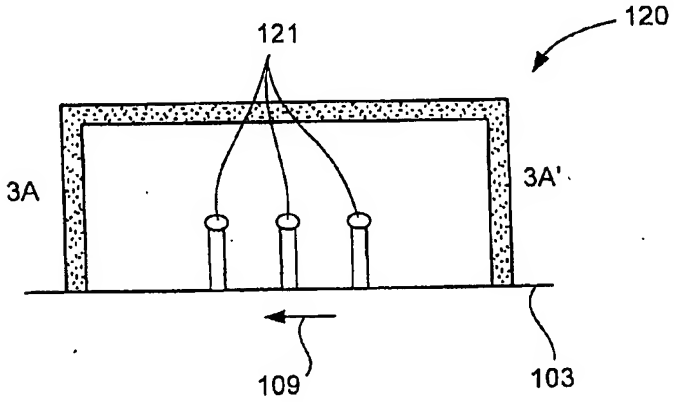

FIG. 3(b)

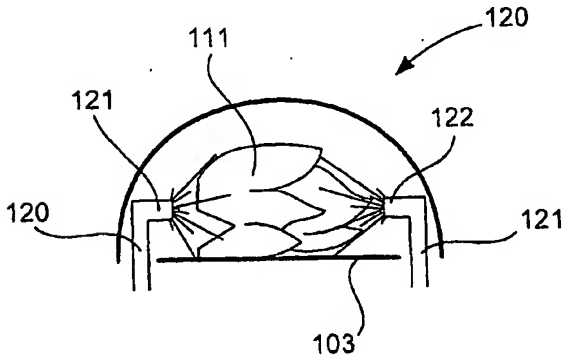

FIG. 3(c)

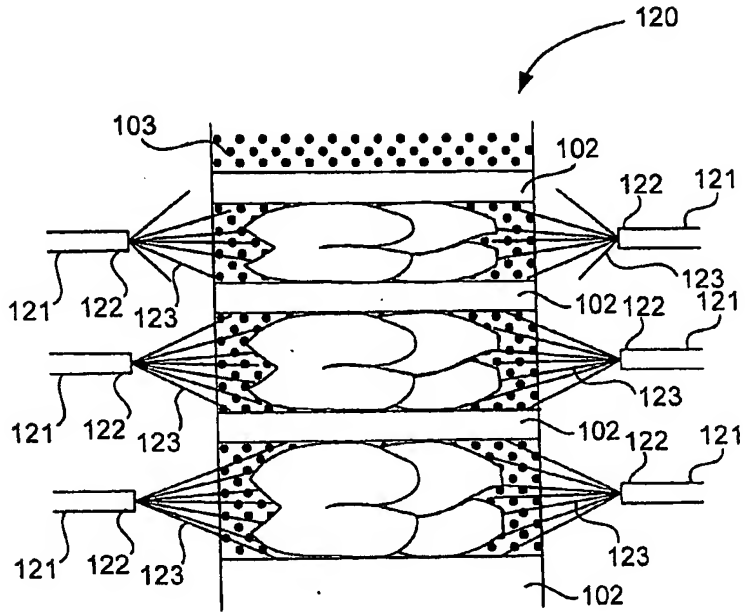
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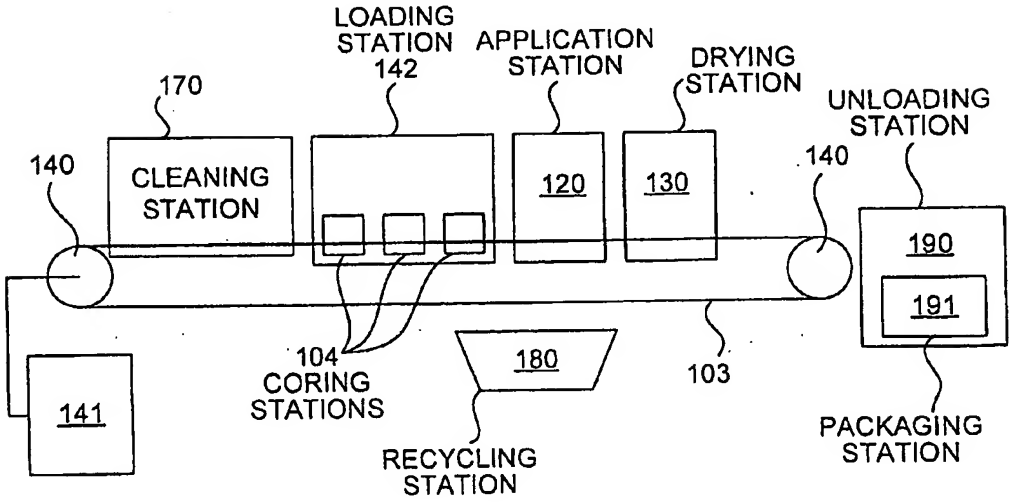
FIG. 3(d)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APPLICATION STATION
DRYING STATION
UNLOADING STATION
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CLEANING STATION
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CORING STATIONS
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RECYCLING STATION
PACKAGING STATION

FIG. 4(a)

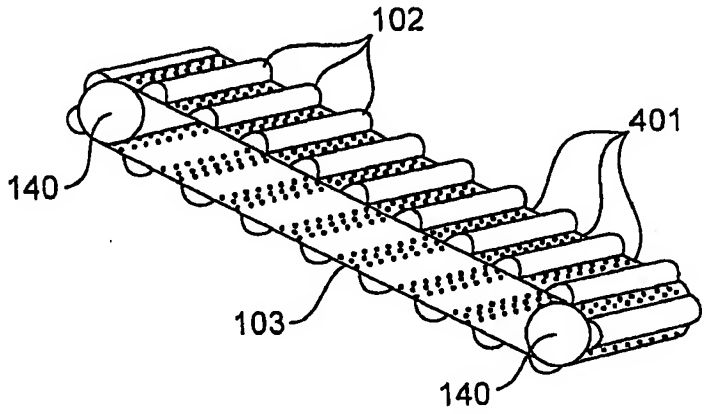


FIG. 4(b)

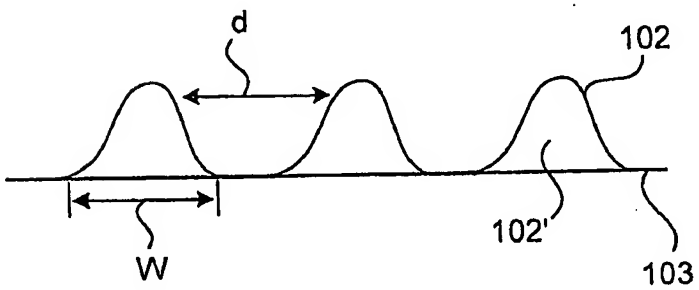


FIG. 4(c)

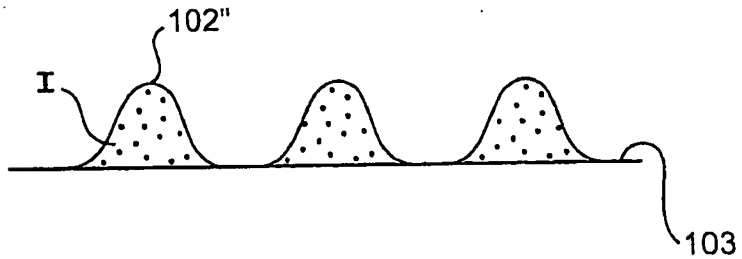


FIG. 4(d)

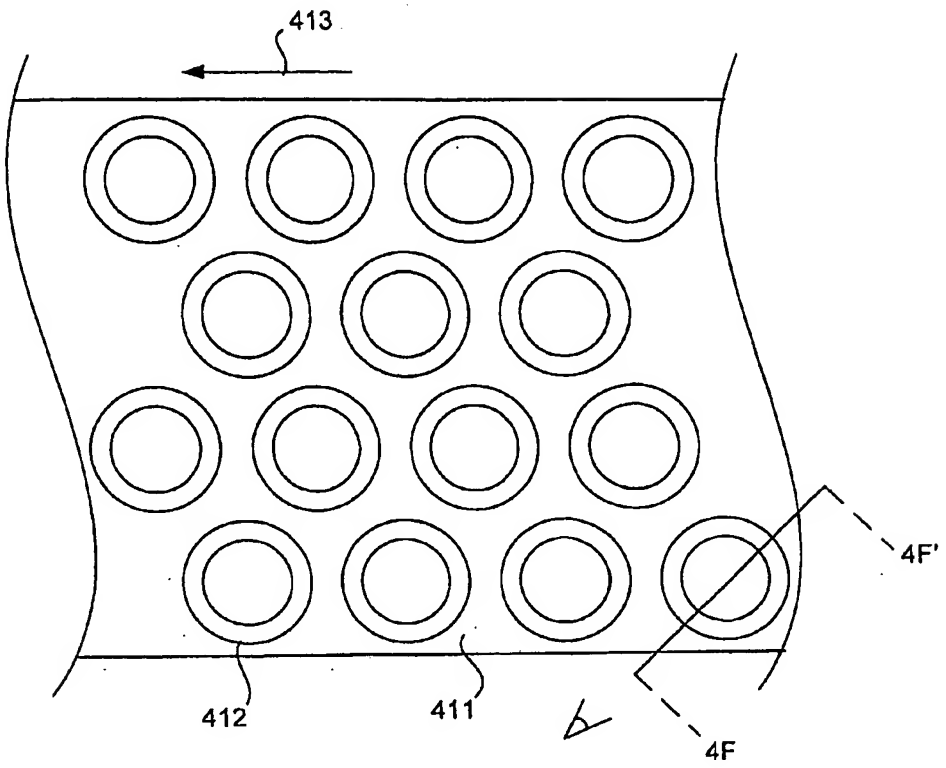


FIG. 4(e)

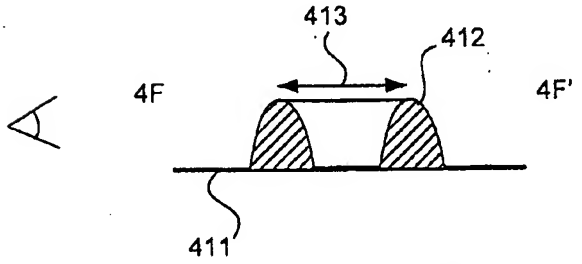


FIG. 4(f)

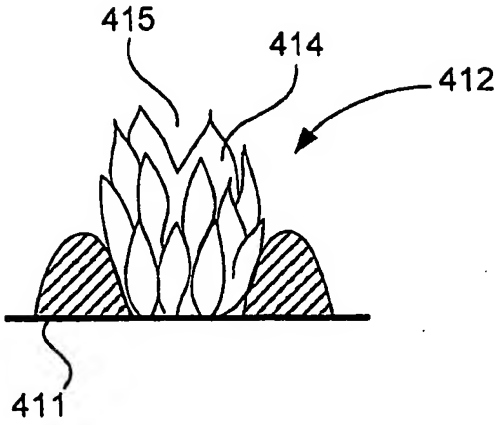


FIG. 4(g)

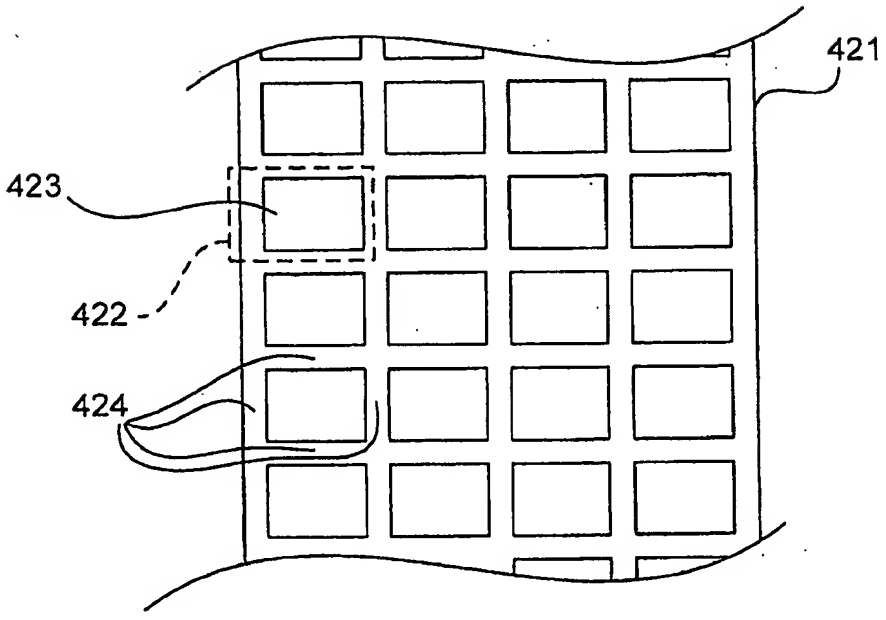


FIG. 4(h)

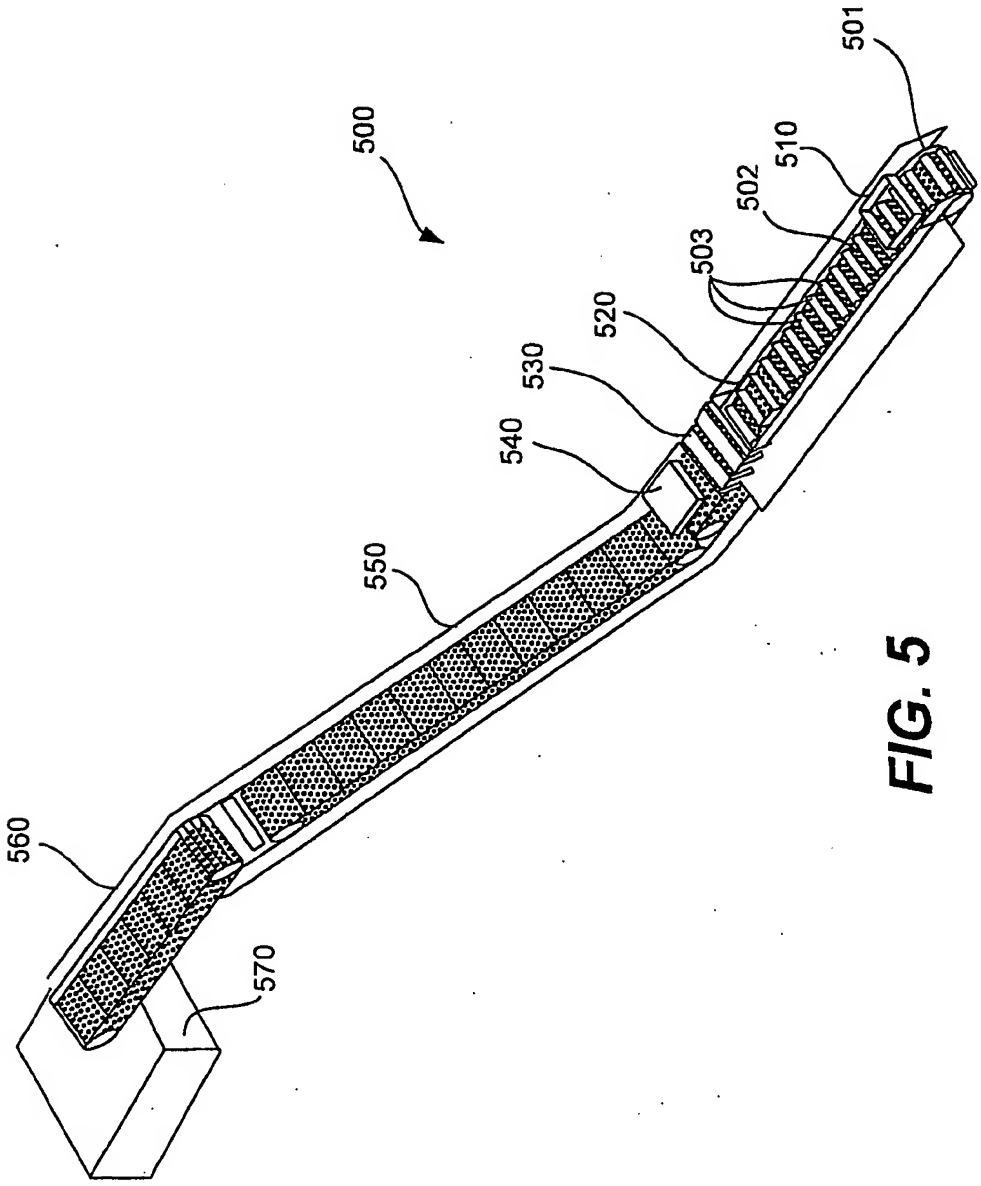


FIG. 5

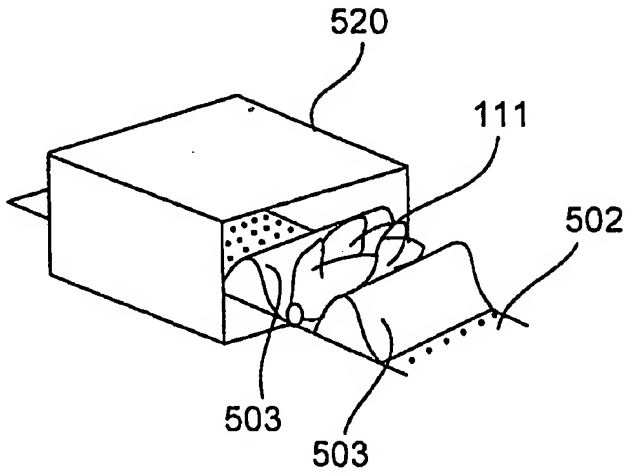


FIG. 6(a)

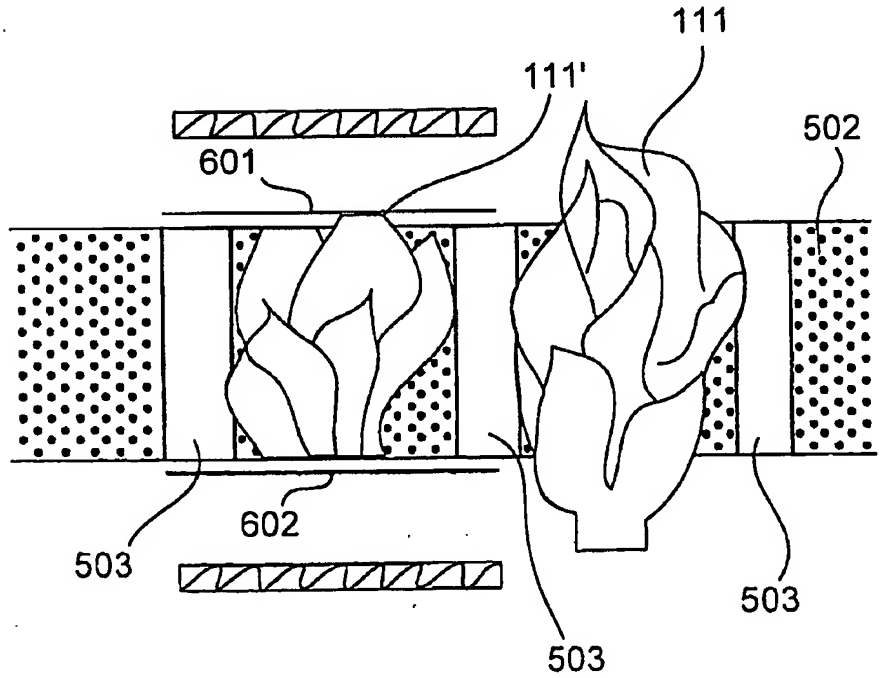
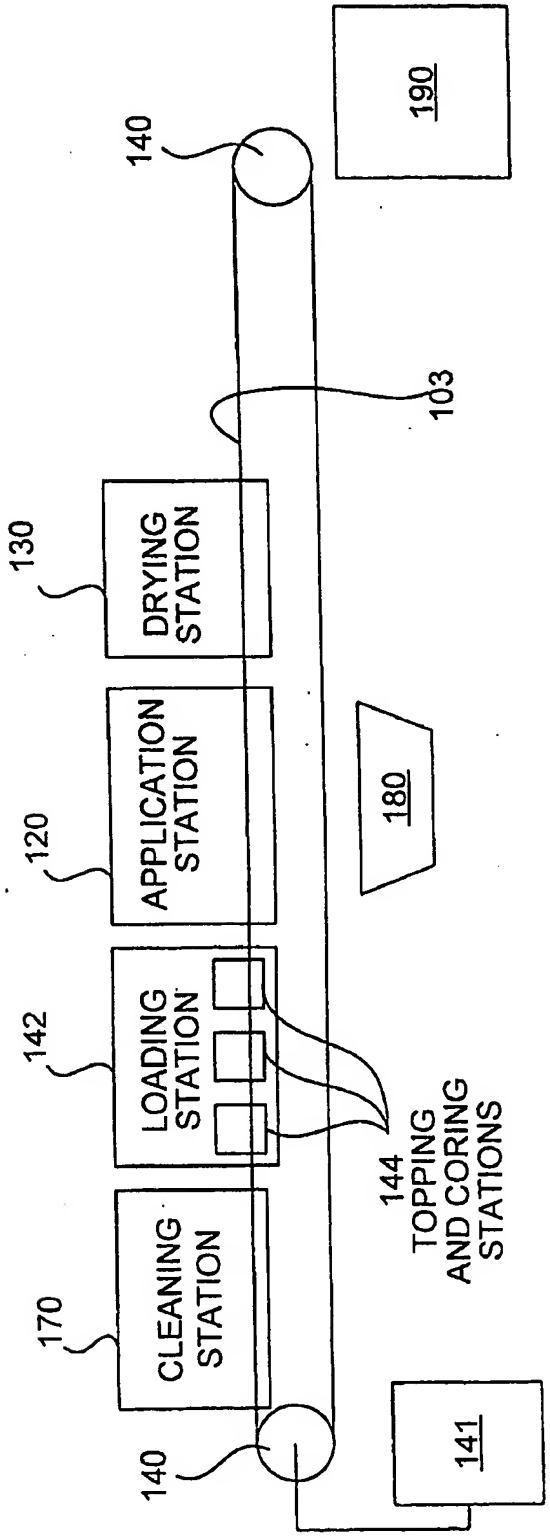


FIG. 6(b)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TOPPING AND CORING STATIONS
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CLEANING STATION
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FIG. 7

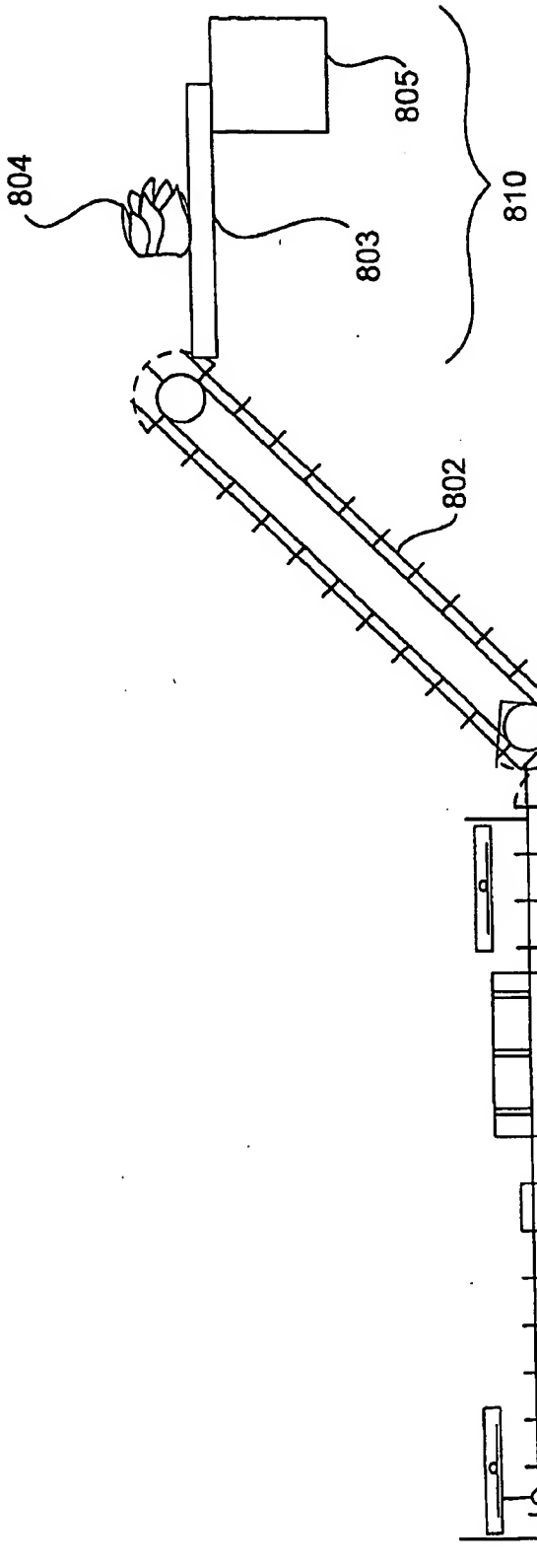

FIG. 8

LETTUCE AND ROMAINE HARVESTING MACHINE AND METHOD

RELATED APPLICATION

[0001] This application claims priority under 35 USC 119(e) from the Provisional Application No. 60/444,729 (Attorney Docket No. AGHTP001P) entitled "LETTUCE HARVESTING MACHINE AND METHOD," which was filed on Feb. 3, 2003, hereby incorporated by reference.

TECHNICAL FIELD

[0002] The invention described herein relates generally agricultural produce harvesting machines. More particularly, the invention relates to methods and apparatus for "topping" and "coring" agricultural produce products (e.g., lettuce, romaine lettuce, and other similar produce products).

BACKGROUND

[0003] In conventional harvesting of agricultural products, most of the work is done by hand. This leads to a number of problems and inefficiencies that result in the production of less usable agricultural product. These problems are especially pronounced with respect to the harvesting of lettuce and other related leafy produce products. As is known to persons having ordinary skill in the art, lettuce refers to a wide range of lettuce agricultural products. Examples include, but are not limited to, romaine lettuce (also referred to as romaine), red leaf lettuce, green leaf lettuce, butter lettuce, and other lettuce varieties. "Romaine" has an elongated head, with deep green outer leaves and a fresh, slightly yellow center. Romaine is a desirable produce product for a number of reasons, including its high nutrient content. In this application, romaine, leaf lettuce, and other similar agricultural products are referred to generally as "lettuce".

[0004] Conventionally, romaine (and other lettuce products) is harvested by hand in the field. Romaine is "topped" and "cored" by hand in the field. "Topping" is the process of removing the top portion of the leaves of the lettuce. Commonly, a knife is used to cut away the top portion of the romaine. In conventional harvesting the harvester grabs the romaine and holds it firmly in place while cutting away the top with a knife. This process is not delicate and frequently results in bruising and mechanical damage to the romaine.

[0005] Additionally, many buyers of lettuce desire their lettuce "cored". "Coring" is the process of removing the stem and some center portions of the lettuce. A knife is commonly used to cut away the stem and certain undesirable inner portions of the lettuce, thereby coring the lettuce. During coring the harvester grabs the lettuce and holds it firmly in place while he (or she) cuts away the stem and core with a coring knife blade. Again, such a process, as currently practiced, is not delicate and frequently leads to bruising and mechanical damage to the lettuce.

[0006] After coring and topping, only the choicest most desirable portions of the lettuce should remain. However, manual coring and topping, as currently practiced, frequently results in excessive amounts of high quality lettuce being discarded due to inaccurate, inconsistent, and excessive topping and coring.

[0007] Additionally, lettuce is commonly treated with a chlorine and water solution (or other similar solutions) to reduce the spoilage and undesirable discoloration resulting from coring and topping. However, the current manual spray application of such solutions frequently results in ineffectual and incomplete treatment of the lettuce. Alternatively, current manual processes frequently result in the excessive application of water. Too much water, especially when coupled with mechanical damage and bruising leads to decay, spoilage, and other deterioration of the lettuce product. This problem is frequently worsened by the presence of residual water on the lettuce from the fields where the lettuce is grown.

[0008] What is needed is a method and apparatus for coring and cutting lettuce (as well as other like agricultural products) that reduces bruising and mechanical damage during the coring and topping process. Additionally, the method and apparatus should efficiently and effectively be able to apply shelf life extenders onto the cut ends of the lettuce without the excessive application of water. Moreover, embodiments of the method and apparatus can reduce the amount of moisture and residual contamination (dust, dirt, etc.) on the final lettuce product. These and other attributes of the inventive concept will be discussed in greater detail herein.

SUMMARY

[0009] Embodiments of the invention include a produce harvesting apparatus. The apparatus includes a conveyor system for conveying harvested produce between workstations. The conveyor system includes a conveyor belt driven over rollers by a drive element. The belt further including a plurality of cushioned produce holders suitable for holding produce products in a desired orientation on the belt during operation. The apparatus includes a coring station suitable for at least one of coring the produce and topping the produce. The apparatus includes a loading station wherein the produce is loaded having the desired orientation, onto the cushioned produce holders of the conveyor system. The apparatus includes an application station for applying shelf life extending materials onto at least one of a cored portion of the produce and a topped portion of the produce. The apparatus includes an unloading station for removing the produce from the conveyor belt.

[0010] Embodiments of the invention include a conveyor belt for use in a produce transport system. Such belt includes a support belt having a plurality of cushioned produce holders arranged thereon. The cushioned produce holders are suitable for holding produce products in place and in a desired orientation on the belt during operation. The cushioned produce holders are configured to limit bruising and damage to the produce products placed on the produce holders.

[0011] Embodiments of the invention also include a transport system for conveying produce between workstations. Included in the transport system are a conveyor system including a plurality of cushioned produce holders suitable for holding produce products. The cushioned produce holders are configured hold produce products in place in a desired orientation on the conveyor system as the conveyor system moves the produce products from one workstation to another workstation, and wherein the cushioned produce holders are configured to reduce the amount of damage done to the produce products as they are conveyed on the con-

veyor system. The transport system includes a loading station for loading produce products into the cushioned produce holders and an unloading station for unloading the produce products from the cushioned produce holders.

[0012] Embodiments of the invention further include coring stations for removing a core portion of a produce product. Said coring stations include a base board suitable for having produce products placed thereon and a coring blade shaped for cutting away a core portion of a produce product placed on the base board. The coring station includes a blade mount configured so that the coring blade can be adjustably positioned in order to achieve a desired cut on the produce product in order to cut away a core portion of the produce product.

[0013] Another embodiment includes a coring blade for including a knife portion attached to one end of a shaft and a handle attached to the other end of the shaft. The shaft includes a recoil mechanism. The knife portion is configured to cut away an increased proportion of the core portion of the produce product and cut away a decreased portion of the outer portion of the produce product while making a straight cut through the produce product with the coring blade.

[0014] Yet another embodiment of the invention comprises a method for harvesting and packaging produce. The method involves harvesting the lettuce. At least one of coring and topping the lettuce is performed. The lettuce is loaded onto the cushioned produce holders of a conveyor system where they are held as they are conveyed to an application station. Shelf life extending materials are applied onto the lettuce, wherein the shelf life extending materials are applied onto a cored portion and a topped portion of the lettuce. The lettuce are unloaded from the cushioned produce holders and packaged.

BRIEF DESCRIPTION OF THE DRAWINGS

[0015] The following detailed description will be more readily understood in conjunction with the accompanying drawings, in which:

[0016] FIGS. 1(*a*)-1(*b*) are simplified schematic depictions of a produce processing apparatus in accordance with the principles of the invention.

[0017] FIGS. 2(*a*)-2(*d*) are simplified illustrations depicting an embodiment of a coring station and a resultant cored head of lettuce in accordance with the principles of the invention.

[0018] FIGS. 2(*e*)-2(*g*) depict embodiments of a portion of a coring blade in accordance with the principles of the invention.

[0019] FIGS. 3(*a*)-3(*d*) are simplified illustrations depicting various views of an embodiment of an application station for applying shelf life extenders onto a head of lettuce in accordance with the principles of the invention.

[0020] **FIG. 4**(*a*) is a simplified block diagram illustrating aspects of a produce harvesting apparatus embodiment constructed in accordance with the principles of the invention.

[0021] **FIG. 4**(*b*) is a perspective view of an embodiment of a conveyor belt constructed in accordance with the principles of the invention.

[0022] FIGS. 4(*c*)-4(*h*) illustrate various embodiments of produce holders in accordance with the principles of the invention.

[0023] **FIG. 5** is a simplified perspective depiction of an alternative embodiment of a produce processing apparatus in accordance with the principles of the invention.

[0024] FIGS. 6(*a*)-6(*b*) schematically depict various views of a cutting and coring station embodiment in accordance with the principles of the invention.

[0025] **FIG. 7** is a simplified block diagram illustrating aspects of an alternative harvesting apparatus embodiment constructed in accordance with the principles of the invention.

[0026] **FIG. 8** is depicts an alternative apparatus embodiment including reconfigured conveyor elements and an elevated unloading and packaging station constructed in accordance with the principles of the invention.

[0027] It is to be understood that, in the drawings, like reference numerals designate like structural elements. Also, it is understood that the depictions in the Figures are not necessarily to scale.

DETAILED DESCRIPTION OF THE DRAWINGS

[0028] Several example implementations illustrating certain aspects of the present invention are now described with reference to the following drawings. It is expressly pointed out that the following described embodiments are examples only, and are intended to describe, rather than limit aspects of the invention. It is expressly contemplate that the scope of the invention extends beyond the limited examples provided and discussed herein.

[0029] FIGS. 1(*a*)-1(*b*) include side and perspective views of an apparatus embodiment of the present invention. The depicted embodiment is a processing machine used, in preferred implementation, to process harvested romaine. The machine includes a conveyor system having a plurality of cushioned produce holders for holding romaine. The depicted apparatus further includes loading stations and coring stations for coring the harvested romaine and loading the romaine onto the cushioned produce holders. The depicted apparatus further includes an application station for applying shelf life extending materials onto the harvested and cut romaine. The apparatus is shown with an optional cleaning station configured to remove excess moisture and debris from the conveyor system. The depicted apparatus is shown with an optional leaf drying station configured to remove excess moisture and debris from the romaine and conveyor system. Optionally, the system can also include a recycling system for recycling excess shelf life extending materials.

[0030] **FIG. 1**(*a*) is a perspective view depicting a lettuce processing apparatus **100** embodiment in accordance with the principles of the invention. The machine includes a conveyor system having a plurality of cushioned produce holders for holding lettuce. In a preferred, but not exclusive implementation, the conveyor system includes a plurality of conveyor elements **101, 150, 160** arranged to convey produce products from one workstation to another. A first conveyor element **101** comprises an endless belt feed conveyor belt **103** driven around a roller system **140** by a drive

device (e.g., a drive motor) so that the objects placed on the belt **103** can be moved in the system. Additionally, in the preferred implementation, the belt **103** includes a plurality of cushioned produce holders. As depicted here, the cushioned produce holders include a plurality of spaced apart cushioned paddles **102** arranged on the belt **103**. In the depicted embodiment, the cushioned paddles **102** are spaced apart a predetermined distance such that a head of romaine can fit easily fit between two adjacent paddles **102**. Moreover, in preferred embodiments, the paddles **102** are spaced close enough to each other so that a head of romaine placed between the paddles **102** is held substantially together to prevent the head from falling apart as it is conveyed in the apparatus **100**. Additionally, in the preferred embodiment, the belt **103** comprises a perforated belt having a multitude of holes running the entire length of the belt **103**. The holes allow moisture to easily drain off the romaine placed on the belt **103** as it is conveyed through the system. Other advantages of the perforated belt will be explained in greater detail below.

[0031] The depicted embodiment also includes a plurality of coring stations **104** that are positioned along the length of the conveyor element **101**. The coring stations **104** facilitate coring of the romaine prior to loading it onto the belt **103**. In the depicted embodiment, a coring board **105** runs along the length of the belt **103**. In the depicted embodiment, the coring stations **104** are attached to the coring board **105**.

[0032] In the depicted embodiment, heads of romaine are manually harvested and topped prior to being placed on the conveyor system **101**. Coring of these topped heads of romaine is accomplished at the coring stations **104**. The coring stations **104** of the depicted embodiment are manual coring stations wherein an individual harvester cores each head of romaine as it arrives at the coring station **104**. However, it is specifically contemplated by the inventors that automated coring stations, having automatic alignment and cutting apparatus, can be used to core the heads of romaine. Once the romaine is cored at the coring stations **104**, the romaine is loaded between the cushioned paddles where it is moved to other stations of the apparatus **100**. Thus, the coring stations **104** also serve as "loading stations" where the cored and topped romaine can be loaded onto the belt between the cushioned produce holders (e.g., the paddles **102**) for further transport in the system **100**. As the conveyor belt **103** advances (indicated by arrow **109**, which indicates the direction that the top surface of the belt **103** moves) the romaine advances toward application station **120** which is used for applying shelf life extending materials onto the romaine. After application of the shelf life extending materials, the romaine can be dried at leaf drying station **130**. If desired, additional conveyor elements **150, 160** can be incorporated to further convey the romaine in the system **100**. Also, the system **100** can incorporate a cleaning station **170** for cleaning residue and detritus from the belt and produce holders during use.

[0033] It is to be noted that the additional conveyor elements **150, 160** can use cushioned produce holders or alternative types of transport modules. For example, FIG's. **1**(*a*) and **1**(*b*) show conveyor element **150** having more rigid flights that hold the romaine in securely place as it is advanced upward onto another conveyor element **160** that (in this case) does not include either cushioned produce holders or alternative transport modules.

[0034] FIGS. **2**(*a*), **2**(*b*), and **2**(*c*) illustrate a manual coring station **104** embodiment in a number of views. **FIG. 2**(*a*) is a top plan view of a coring station **104** embodiment. The coring board **105** is typically positioned adjacent to a perforated conveyor belt **103**. In the depicted embodiment, a portion of the coring board **105** is shown in position adjacent to a perforated conveyor belt **103** with a plurality of cushioned paddles **102**. The arrow **103'** shows a direction of motion for the conveyor belt **103**. The depicted coring station **104** includes a coring blade mount **104'** that is used to position a coring blade so that a desired coring cut can be made into a head of romaine. The depicted coring blade mount **104'** includes three openings **106** spaced to provide three different sized cuts. A coring blade can be placed at each different opening **106** to facilitate different cuts. As is well known to persons having ordinary skill in the art, the coring blade mount **104'** can incorporate many different approaches for positioning a coring blade at a desired position.

[0035] The perspective view of the coring station **104** embodiment shown in **FIG. 2**(*a*) shows that, in preferred embodiment, the coring board **105** of the coring station **104** is positioned slightly above the conveyor belt **103**. This facilitates the easy sliding of cored lettuce from the coring station **104** onto the conveyor belt **103**. Also shown is a handle portion h of a coring blade with a shaft S portion extending through a desired opening **106**.

[0036] **FIG. 2**(*c*) is a side view of the coring station **104** embodiment shown in FIGS. **2**(*a*) and **2**(*b*). This view can be used to illustrate aspects of operation of the coring station **104**. The coring blade **110** is installed in the coring station **104**. In the depicted embodiment, the blade **110** includes a handle h that is attached to a sharp knife blade k using a shaft S. The shaft also includes a recoil mechanism L which is depicted here as a spring. In one implementation, the blade **110** operates as follows: the handle h is removed and the shaft s is slide through one of the openings **106** to position the blade **110**. The recoil mechanism L is placed to spring load the handle h for easy use. During operation, a head of romaine **111** is placed on the coring board **105** such that the base **112** of the lettuce is flush with a backing portion **107** of the coring station **104**. The coring blade **110** is pushed downward (arrow **108**) through the romaine **111** cutting away a core portion of the romaine. The recoil mechanism L pushes the blade **110** back upward into the start position. The cored romaine **111** is then placed onto the conveyor belt **103** where it is moved onward for further processing.

[0037] **FIG. 2**(*d*) depicts a cored piece of lettuce **111** showing a core cut at the base **112** of the lettuce used to remove the core portion **113** of the lettuce. The depicted embodiment shows a substantially V-shaped cut (portion **113**) used to remove the core potion **113**. Although V-shaped cuts are preferred (due to the ease in blade manufacture) the inventors contemplate that any suitable cut shape (e.g., U-shaped, or a flat cut removing the entire bottom portion of the head of lettuce, as well as other cuts) can be used.

[0038] **FIG. 2**(*e*) depicts one embodiment of a suitable coring blade. Depicted are the handle h and the corresponding shaft s attached to a coring blade **110**. In the depicted embodiment, the coring blade **110** is configured so that a substantially V-shaped core cut will be made in a head of lettuce. Two blade edges **110'** are arranged at an angle from

each other to facilitate a substantially V-shaped core cut. Such a V-shaped knife blade is a desirable implementation. A spring can be positioned on the shaft (e.g., as shown in **FIG. 2**(*c*) to facilitate spring loading if desired.

[0039] Examples of other advantageous knife blade implementations are depicted in the "truncated-V shape" of **FIG. 2**(*f*) and the "U-shaped" blade of **FIG. 2**(*g*). Each of the depicted knife blades enable a coring blade to remove a substantial portion of a core portion of a romaine head while preserving a substantial portion of the outer leaves, all while using a straight cut of blade through the romaine. As is readily appreciated by those having ordinary skill in the art, such blades are readily applicable to many varieties of lettuce (including without limitation "iceberg" lettuce and other similar leafy lettuce products).

[0040] Returning to **FIG. 1**(*a*), once the romaine is cored it is placed on the conveyor belt **103**. The cored romaine is placed on the cushioned produce holders (e.g., between paddles **102**) of the belt **103**. In the depicted embodiment, the lettuce is placed between the spaced apart paddles **102** of the belt **103**. As the conveyor belt **103** advances (indicated by arrow **109**, which indicates the direction that the top surface of the belt **103** moves) the romaine also advances toward application station **120** which is used for applying shelf life extending materials onto the romaine.

[0041] One embodiment of an application station **120** is depicted in **FIG. 3**(*a*). **FIG. 3**(*a*) is a top down view of a conveyor belt **103** and application station **120**. Romaine **111** is positioned on the belt **103** between the cushioned paddles **102**. As the lettuce **111** is moved (in direction **109**) into the application station **120** shelf life extension materials are applied onto the cut ends of the lettuce **111** (not shown in this view).

[0042] Generally, shelf life extenders are used to encapsulate the cut ends of produce products to prevent a wide range of deterioration. For example, the application of shelf life extenders can prevent enzymatic browning, "pinking", as well as dehydration. Examples, of such shelf life extending materials include, but are not limited to, chlorine and water solutions; water/hypochlorite/salt/starch solutions; water/protein solutions; as well as many others. Another particularly useful type of shelf life extender is a protein/water solution. Importantly, solid shelf life extenders can also be applied to the romaine in solid form (e.g., as an atomized powder). Additionally, such shelf life extenders can be applied as aerosols. The reader is reminded that although disclosed with respect to romaine, the shelf life extending materials discussed herein can be readily applied to other lettuce products as well as related agricultural products.

[0043] In preferred implementation, the cut ends of the romaine are well treated with shelf life extenders and the middle (un-cut) portions of the romaine are treated with little or no shelf life extender. In one embodiment, this can be accomplished by applying the shelf life extender directly onto the cut end portions of the romaine. For example, in one implementation, the shelf life extender can be sprayed from directly onto the ends of the romaine in a direction toward the center of the lettuce. In such an embodiment, the shelf life extender can be applied with spray nozzles that spray in a direction substantially parallel to the long axis of the lettuce so that the spray is directly onto the cut ends of the lettuce. Such an application is referred to herein as axial application of the shelf life extending materials. **FIG. 3**(*c*) depicts one example of such an application.

[0044] **FIG. 3**(*b*) shows a cross-section view of the application station **120** embodiment depicted in **FIG. 3**(*a*) (the cross-section being taken along 3A-3A'). Lettuce is carried on the conveyor belt **103** into the application station **120** where shelf life extender is applied. In the depicted embodiment, the shelf life extender is in an aqueous solution and is sprayed onto the cut ends of the romaine. In the depicted embodiment, this is accomplished by three sprayers **121** positioned on either side of the romaine. The sprayers **121** are configured so that they spray the shelf life extender onto the ends of the romaine without spraying very much on the middle portions of the romaine.

[0045] **FIG. 3**(*c*) is an end on view of the application station **120** embodiment depicted in **FIG. 3**(*a*) as viewed in direction **3B**. The romaine **111** is positioned on the belt **103** so that the cut ends of the romaine face toward the sprayers **121** (or in the case of dry shelf life extender, the dispensers) which spray shelf life extender onto the cut ends of the romaine **111**. In the depicted embodiment, the sprayers **121** can include adjustable nozzles **122** that can be adjusted to regulate the volume of shelf life extender sprayed and to reduce the amount of over-spray onto un-cut portions of the romaine **111**. The depicted embodiment displays an example of an axially applied shelf life extender. Romaine **111** is positioned so that one end of the romaine (e.g., the cut top) faces one side of the belt **103** and the other end of the romaine (e.g., the cored bottom) faces the other side of the belt **103**. In this manner the shelf life extending material can be axially applied from each side. From one side onto the cut top (i.e., by spraying onto the top along the axis of the romaine) of the romaine and from the other side onto the cored bottom (i.e., by spraying onto the bottom along the axis of the romaine) of the romaine so that a minimum of shelf life extender is sprayed onto uncut portions of romaine.

[0046] **FIG. 3**(*d*) is another view of the application station **120** embodiment depicted in **FIG. 3**(*a*). The depicted view is a top down view of a portion of the application station **120** with the top cover removed. The romaine **111** are positioned on the belt **103** lying on their side between the cushioned paddles **102** such that the top of the romaine faces one side of the belt **103** and the bottom of the romaine faces the other side of the belt **103**. In this way the paddles **102** gently hold the romaine **111** in place. Moreover, the romaine **111** are positioned so the spray from the sprayers **121** is directed preferentially onto the cut ends of the lettuce while minimizing the over-spray onto the un-cut portions of the lettuce **111**. Typically, the cut ends face toward the sprayers **121**. In the depicted embodiment, six sprayers **121** are depicted (the actual number being variable) spraying a fan **123** of shelf life extender onto the cut ends of the romaine. As previously described, the sprayers **121** can include adjustable nozzles **122**. This is an example of axial application of the shelf life extending materials. The inventors specifically contemplate that embodiments of the application station **120** can include other methods of applying the shelf life extender. Aerosol dispensers, dust applicators, as well as numerous other methods of applying the shelf life extender are contemplated. Moreover, it is specifically contemplated that the shelf life extender can be applied at the application station in a solid form (e.g., as a powder or other like material).

[0047] The excess spray and moisture drips off the belt **103** where it is collected by a recycling system (not shown in this view) that filters excess run off for reuse by the system. The use of a perforated belt **103** offers further advantages in that the excess moisture is more easily drained through the belt **103** into the recycling system.

[0048] Referring again to **FIG. 1**(*a*), after application of the shelf life extender the conveyor belt of the depicted embodiment advances the lettuce to a "leaf drying" station **130**. The leaf drying station **130** blows air onto the cored, topped, and treated (with shelf life extender) romaine. This dries excess moisture from the romaine and can be used to remove lingering debris from the lettuce. Also, the blown air of the leaf drying station **130** can be used to dry the belt **103** as well as remove debris from the belt **103**. Typically, the leaf drying station **130** comprises a fan arrangement that creates an air flow that is directed onto the romaine as it passes. Additionally, the leaf drying station **130** is not limited to the use of fans to generate air flow, many other air flow devices can be used to direct air onto the romaine. The air flow should be sufficient to remove substantially portions of moisture and debris from the romaine without blowing so hard as to damage the romaine or blow it off the belt **103**.

[0049] At this point the romaine is ready for further processing. In the embodiment of **FIG. 1**(*a*) the romaine is then loaded on to another second conveyor element **150** which elevates the romaine onto a third conveyor element **160** which can convey the romaine to a loading station where it can be unloaded for further processing, packaging, or loading. The inventors specifically contemplate many other further processing approaches and the depicted second and third conveyors elements (**150, 160** respectively) are merely one possible implementation.

[0050] With further attention to **FIG. 1**(*a*), once the belt **103** offloads the lettuce for further processing (e.g., onto conveyor system **150**) the belt **103** continues in operation. However, during use the belt **103** becomes quite wet with spray and field moisture. Additionally, quite a bit dirt, lettuce residue, bacteria, and other assorted detritus accumulate on the belt **103** during ordinary usage. Such accumulations have harmful effects of the final produce product. Therefore, what is need is a methodology for cleaning the belt **103**. Thus, a cleaning station **170** is used to remove excess moisture and debris from the belt **103** prior to romaine being loaded onto the belt **103**. Therefore, the cleaning station **170** reduces the moisture present on the system and thereby reducing the extent of contamination, decay, and microbial growth on the romaine. It is to be noted that the cleaning station is not required to practice the principles of the invention.

[0051] However, in the depicted embodiment, the cleaning station **170** blows high pressure air onto the belt **103** to dry excess moisture from the lettuce and remove debris from the belt **103**. Typically, the cleaning station **170** comprises a high power fan arrangement that creates an airflow that is directed onto the potions of the belt **130** as they pass. Additionally, the cleaning station **170** is not limited to the use of fans to generate airflow, many other air flow devices can be used to direct air onto the romaine. The airflow should be sufficient to cause significant drying of the belt and remove significant amounts of debris from the belt **103**. As before, a high pressure fan system can be used to clean the belt **103**. Moreover, other high pressure air systems can be used to clean the belt. In one implementation, the belt **103** is perforated allowing superior airflow through the belt as well as superior drainage. Thus, while not required, embodiments using perforated belts **103** are preferred.

[0052] **FIG. 4**(*a*) is a block schematic diagram showing a simplified implementation of an apparatus in accordance with the principles of the invention. The depicted embodiment includes a conveyor system having a conveyor element **101** that includes a belt **103** with a plurality of cushioned produce holders for holding produce products (e.g., lettuce and other like produce products). The belt **103** is driven by a drive element **141** over a set of rollers **140** to enable items placed on the conveyor belt to be moved from place to place in a system. The belt **103** passes through a cleaning station **170** configured to remove excess moisture and debris from the conveyor system. The apparatus further includes a loading station **142** for loading produce products onto the belt **103**. Typically, the loading station **142** includes a plurality of coring stations **104** for coring the harvested produce products. The produce products are treated with shelf life extending materials at an application station **120**. The produce products then pass to a leaf drying station **130** configured to remove excess moisture and debris from the produce and conveyor system. The belt **103** is used to convey the produce products to an unloading station **190** which can include a packaging station **191** for packaging the off-loaded produce. Optionally, the system can include a recycling system **180** for recycling excess shelf life extending materials. It should be noted that all the systems discussed herein (including the drive element **141** for powering the belt **103**) can be separately powered (e.g., by motors, generators, or other suitable power sources) or powered by an associated vehicle (e.g., a truck or other like vehicle). Additionally, it is to be noted that the cleaning station **170** and the drying station **130** are not required to practice the invention. Moreover, the schematically depicted belt **103** and drive system (**140, 141**) can encompass several interconnected belt and drive systems.

[0053] An important aspect of the invention is the conveyor system. In particular, embodiments of the invention include an improved belt apparatus having a plurality of cushioned produce holders formed thereon. The cushioned produce holders enable lettuce (as well as other similar produce products) to be set on the belt cushioned by the produce holders so that the damage to the outer leafy portions of the produce is minimized as it is transported from workstation to workstation. **FIG. 4**(*b*) is a simplified depiction of a belt **103** in accordance with the principles of the invention. The belt **103** is depicted here as an endless belt **103** driven over a roller system **140** defined by two rollers **140**. Persons having ordinary skill in the art appreciated that roller systems having many different rollers, supports, and drive systems can be used in conjunction with the belts of the invention. Belts **103** constructed in accordance with the principles of the invention include a plurality of cushioned produce holders formed thereon. In the depicted embodiment, the cushioned produce holders comprise cushioned paddles **102** which are arranged on a support belt **103** at a spaced apart distance to facilitate the loading of produce products. Additionally, in some embodiments, the belt **103** includes perforations **401** to allow the ready drainage of excess moisture off the belt and produce.

[0054] FIG. 4(*c*) is a side view of a portion of one belt embodiment. The belt **103** includes a plurality of spaced apart cushioned paddles **102**. The paddles can be formed of any suitably flexible material. In one embodiment, the paddle **102** is formed of a PET (polyethylene terephthalate) strip about 1/16th of an inch thick In this embodiment, the cushioned paddles **102** comprise a layer of material (e.g., PET) arranged in a bowed configuration to provide padding to the produce products (commonly lettuce) placed between the cushioned paddles **102**. The paddles **102** in this embodiments attain some of their cushion by having an empty interior cavity **102'** that allows the paddle **102** to flex when produce rests against it. When the belt **103** is used in romaine harvesting, preferred embodiments of the paddles **102** are spaced apart a distance d of about 2½ inches. Additionally, the paddles **102** have a width w of about 2½ inches. When the belt **103** is used with lettuce (for example, iceberg lettuce), the paddles **102** can be spaced apart a distance d of about 3 inches with the paddle width w still being about 2½ inches. The inventors contemplate that other suitable materials can be used to fashion the paddles **102**.

[0055] FIG. 4(*d*) illustrates another paddle embodiment in accordance with the principles of the invention. The depicted embodiment is a side view of a portion of a belt embodiment. The belt **103** includes a plurality of spaced apart cushioned paddles **102"**. The depicted paddles **102"** are solid or filled paddles. Such paddles **102"** can be formed of any cushiony material suitable for cradling produce in accordance with the principles of the invention. For example, the surface can be formed of a thin layer of PET and the inside I can be filled with a soft flexible foam material. Alternatively, the paddles **102"** can be one solid mass of flexible material.

[0056] In another approach the paddles can be replaced with a plurality of cushioned pads configured to hold lettuce so that a head of cored lettuce does not fall apart and so that the head of cored lettuce can be oriented with the cored portion pointing straight up. One such implementation is disclosed with respect to FIG. 4(*e*). FIG. 4(*e*) is a plan view of a portion of a belt **411** having a plurality of annular cushioned pads **412** formed thereon. The arrow **413** indicates a direction the belt **411** moves the lettuce.

[0057] FIG. 4(*f*) depicts a cross-section view 4F--4F' of a portion of a belt **411** and an annular cushioned pad **412**. The belt **411** typically, includes perforations (not shown in these views) for facilitating the easy drainage of moisture from the belt and associated lettuce. In one embodiment, the central interior portion **413** of the cushioned annular pad **412** is about three (3) inches in diameter to facilitate its use with iceberg lettuce. FIG. 4(*g*) is an illustration of the cushioned annular pad **412** having a head of lettuce **414** placed in the central interior portion **413**. The head of lettuce **414** is positioned having its cored portion **415** pointing upward so that shelf life extending materials can easily be applied. The outer leaves of the lettuce **414** are held together by the walls of the cushioned annular pad **412**. As the head of lettuce **414** passes through an application station, shelf life extending materials are applied downward (e.g., sprayed or dusted) onto the cut and cored portion **415** of the lettuce **414**. As is readily appreciated by those of ordinary skill in the art, the foregoing embodiments can be used with many lettuce varieties as well as with other similar produce products.

[0058] In another embodiment, the cushioned pads can be configured a plurality of "squares" arranged to hold lettuce so that a head of cored lettuce does not fall apart and so that the head of cored lettuce is oriented with the cored portion pointing straight up. One such implementation is disclosed with respect to FIG. 4(*h*). FIG. 4(*h*) is a plan view of a portion of a belt **421** having a plurality of cushioned pads **422** formed thereon. As with the other embodiments, an open center portion **423** of the cushioned pad **422** is configured so that cushioned pad walls **424** the outer leaves of the lettuce together with the rest of the head of lettuce. As can be appreciated by those having ordinary skill in the art, many other configurations are possible.

[0059] FIG. 5 is a simplified perspective view of another, more automated, embodiment of a harvesting apparatus **500** in accordance with the principles of the invention. The depicted embodiment includes a first conveyor element **501** having a belt **502** with a plurality of cushioned produce holders **503** for holding lettuce. The principles of operation of the first conveyor system **501** and cushioned produce holders **503** are the same as described above. The belt **502** passes through a cleaning station **510** configured to remove excess moisture and debris from the conveyor system. The apparatus further includes a topping and coring station **520** that tops and cores the harvested produce products (e.g., romaine). The topped and cored produce is treated with shelf life extending materials at an application station **530**. The topped and cored produce then passes to a leaf drying station **540** configured to remove excess moisture and debris from the lettuce and conveyor system. Optionally, the system can include a recycling system (not shown in this view) for recycling excess shelf life extending materials.

[0060] As previously described elsewhere in this specification, the conveyor element **501** comprises a belt **502** having a plurality of cushioned produce holders **503** for holding harvested lettuce. The mode of operation for the may embodiments of the cushioned produce holders **503** has been previously described. The cleaning station **510** is configured to remove excess moisture and debris from the conveyor element. Fan or blower systems are typically but not exclusively used. Such cleaning station **510** is analogous to the cleaning stations described elsewhere in this specification.

[0061] Produce products (e.g., romaine) is harvested in the field in accordance with conventional practices. The heads of, for example, romaine are loaded into the cushioned produce holders **503**. Once loaded, the romaine heads are conveyed to a topping and coring station **520** where the top and core portions of the romaine are removed. Reference to FIG. 6(*a*) shows a head of romaine **111** passing into a topping and coring station **520**.

[0062] FIG. 6(*b*) depicts the topping and coring station **520** shown in FIG. 6(*a*) with the top cover removed to show the interior workings of the station **520**. The romaine **111** is loaded on the belt **502** so that (in this case) it is held between paddles **503** where it is conveyed into the topping and coring station **520** by the belt **502**. Inside the station **520**, two blades **601** and **602** are positioned to remove the top and bottom portions of the romaine **111**. A top blade **601** cuts away a top portion of the romaine and a bottom blade **602** cuts away a bottom portion of the romaine (including the core) to produce a topped and cored head of romaine **111'**. Thus, the

topping and coring of romaine is accomplished in a fully automated manner. The blades **601** and **602** can comprise any number of different blade implementations. In the depicted embodiment, the blades **601** and **602** are band saw blades of a type readily known to persons having ordinary skill in the art.

[0063] Referring again to **FIG. 5**, once romaine has been topped and cored it passes into an application station **530** where it is treated with shelf life extenders. This process is well described elsewhere in the specification. The application station **530** depicted here is also analogous to application stations described elsewhere in the specification. After application of the shelf life extender, the conveyor belt advances the romaine to a "leaf drying" station **540** which dries the cored, topped, and treated (with shelf life extender) romaine. And can also remove lingering debris from the romaine (and belt). Such a leaf drying station **540** and its process of operation are well described elsewhere in the specification. The leaf drying station **540** depicted here is analogous to leaf drying stations described elsewhere in the specification. The leaf drying station **540** can also be mounted on other conveyor elements (e.g., second conveyor element **550**) of the apparatus.

[0064] At this point the lettuce is ready for further processing. In the embodiment of **FIG. 5** the lettuce is then loaded on to another second conveyor element **550** which elevates the lettuce onto a third conveyor element **560** which can convey the lettuce to an unloading station **570** where it is taken off the belts and can be subject to further processing, packaging, or loading. The inventors specifically contemplate many other further processing approaches and the depicted second and third conveyors elements (**550**, **560** respectively) are merely one possible implementation.

[0065] **FIG. 7** is a block schematic diagram showing another simplified implementation of an apparatus in accordance with the principles of the invention. The depicted embodiment is somewhat similar to that depicted in **FIG. 4(*a*)**. The apparatus includes a first conveyor element having a belt **103** with a plurality of produce holders. The belt **103** is driven (using drive element **141**) over a set of rollers (shown here as a set of two rollers **140**) passes through a cleaning station **170** configured to remove excess moisture and debris from the conveyor element. The apparatus further includes a loading station **142** for loading romaine onto the belt. Additionally, the loading station **142** can include one or more topping and coring stations **144** for topping and coring the harvested romaine. The romaine is treated with shelf life extending materials at an application station **120**. The romaine then passes to a leaf drying station **130** configured to remove excess moisture and debris from the romaine and conveyor element. Optionally, the system can include a recycling system **180** for recycling excess shelf life extending materials. It should be noted that all the systems discussed herein can be separately powered (e.g., by motors, generators, or other suitable power sources) or powered by an associated vehicle (e.g., a truck or other like vehicle). Additional conveyor systems can also form part of the apparatus. Once the romaine has been topped and cored the belt **103** carries it to an unloading station **190**. Personnel remove the romaine from the belt **103** and package the romaine. To that end, the unloading station **190** typically includes a packaging station **191**. For example, the unloading station **190** is arranged so that a team of unloading personnel on the back of a truck can unload the romaine at the unloading station. The packaging station **191** can include a table and packaging boxes for facilitating the sorting and packaging of the romaine into the boxes of other related romaine containers.

[0066] In other implementations, the second conveyor element **150**, **550** and third conveyor element **160**, **560** that are depicted, for example, in FIGS. **1(*a*)** and **5** can be omitted altogether, reconfigured, or replaced by other conveyor systems to accomplish different implementations. For example, referring to **FIG. 8**, a first conveyor system **801** of a romaine processing apparatus (for example as depicted and described previously) feeds processed romaine (i.e., topped, cored, and treated with shelf life extenders) to another conveyor element **802**. The conveyor element **802** elevates the processed romaine onto an unloading and packaging station **810**. In this example, the station **810** includes a table **803** and boxes **805** for loading the processed romaine. The processed romaine **804** is collected on a raised table **803** and put into boxes **805**. Conveniently, the raised and filled boxes **805** can be loaded onto a truck for shipping. In some embodiments, the table **803** is positioned on a truck or next to a truck so that the boxes **805** can easily be loaded onto the truck. The table **803** can include box holders that hold the boxes **805** in place while being loaded.

[0067] The present invention has been particularly shown and described with respect to certain preferred embodiments and specific features thereof. This invention encompasses a harvesting apparatus as well as belts particularized for use with the apparatus. Moreover, the invention encompasses associated methods for processing produce. It should be noted that the above-described embodiments are intended to describe the principles of the invention, not limit its scope. Therefore, as is readily apparent to those of ordinary skill in the art, various changes and modifications in form and detail may be made without departing from the spirit and scope of the invention. In particular, the inventors contemplate that embodiments of the invention can be used to process produce other than lettuce. Other embodiments and variations to the depicted embodiments will be apparent to those skilled in the art and may be made without departing from the spirit and scope of the invention.

We claim:

1. A conveyor belt for use in a produce transport system, the belt comprising:

a support belt; and

a plurality of cushioned produce holders arranged on the support belt, wherein the cushioned produce holders are suitable for holding produce products in place and in a desired orientation on the belt during operation, and wherein the cushioned produce holders are configured to limit bruising and damage to the produce products placed on the produce holders.

2. The conveyor belt of claim 1 wherein the support band includes a plurality of openings formed therein.

3. The conveyor belt of claim 1 wherein the cushioned produce holders comprise cushioned paddles arranged so that produce products placed between the cushioned paddles are held in place as the belt is in use.

4. The conveyor belt of claim 3 wherein each the cushioned paddles comprise a layer of material arranged in a

bowed configuration to provide padding to a produce products placed between the cushioned paddle.

5. The conveyor belt of claim 3 wherein the cushioned paddles are arranged so that romaine produce products placed between the cushioned paddles are held in place in a desired orientation as the belt is in use.

6. The conveyor belt of claim 5 wherein the cushioned paddles are arranged so that the romaine produce products placed between the cushioned paddles are held so that cut ends of the romaine produce products are oriented toward sides of the belt.

7. The conveyor belt of claim 1 wherein the cushioned produce holders include cushioned holding pads arranged on the belt so that produce products placed in the cushioned holding pads are held in place as the belt is in use.

8. The conveyor belt of claim 7 wherein the cushioned holding pads are arranged so that lettuce produce products placed on the cushioned holding pads are held in place in a desired orientation as the belt is in use.

9. The conveyor belt of claim 7 wherein the cushioned holding pads comprise cushioned annular holding pads having an annular shape configured so that produce products placed in an open central portion of the annular holding pads are held in place in a desired orientation as the belt is in use.

10. The conveyor belt of claim 9 wherein the cushioned annular holding pads are suitable for holding an iceberg lettuce product placed in the open central portion of the cushioned pad so that a cut end of the iceberg lettuce product is facing upward from the surface of the belt.

11. A transport system for conveying produce between workstations, the transport system comprising:

a conveyor system including a plurality of cushioned produce holders suitable for holding produce products, wherein the cushioned produce holders are configured hold produce products in place in a desired orientation on the conveyor system as the conveyor system moves the produce products from one workstation to another workstation, and wherein the cushioned produce holders are configured to reduce the amount of damage done to the produce products as they are conveyed on the conveyor system;

a loading station for loading produce products into the cushioned produce holders; and

an unloading station for unloading the produce products from the cushioned produce holders.

12. The transport system of claim 11 wherein the conveyor system includes a conveyor belt including thereon the plurality of cushioned produce holders, the belt being an endless conveyor belt guided over a roller system and being driven by a drive element such that produce products placed in the cushioned produce holders can be conveyed from one workstation to another workstation by the conveyor belt.

13. The transport system of claim 12 wherein the conveyor belts of the conveyor system includes a conveyor belt having a multiplicity of openings formed thereon.

14. The transport system of claim 12 wherein the conveyor system includes a plurality of conveyor belts, each belt including thereon the plurality of cushioned produce holders, each belt being an endless conveyor belt guided over a roller system and being driven by a drive element such that produce products placed in the cushioned produce holders can be conveyed from one workstation to another workstation using said plurality of conveyor belts.

15. An agricultural harvesting apparatus incorporating the transport system of claim 11, wherein the loading station for loading the produce products into the cushioned produce holders includes a plurality of coring stations for coring the produce products; and

wherein the transport system includes an application station for applying shelf life extending materials onto cored portions of cored produce products.

16. An agricultural harvesting apparatus incorporating the transport system of claim 15, wherein the cushioned produce holders of the conveyor system are configured to hold the cored produce products so that the cored portion points upward; and

wherein the application station is arranged so that the shelf life extending materials applied downward onto the cored portions of the cored produce products.

17. An agricultural harvesting apparatus incorporating the transport system of claim 16, wherein the cushioned produce holders comprise annular holding pads configured to hold the cored produce products so that the cored portion of the produce product points upward.

18. An agricultural harvesting apparatus incorporating the transport system of claim 16, wherein the produce product comprises lettuce;

wherein the coring station is suitable for coring lettuce to produce cored lettuce;

wherein the cushioned produce holders are configured to hold the cored lettuce so that the cored portion of the lettuce points upward; and

wherein the application station is arranged so that the shelf life extending materials are applied downward onto the cored portions of the lettuce.

19. An agricultural harvesting apparatus as in claim 15 further including a cleaning station for cleaning the conveyor system and the cushioned produce holders.

20. An agricultural harvesting apparatus as in claim 19 further including a drying station for drying excess moisture off the produce product after they have been treated in the application station.

21. An agricultural harvesting apparatus as in claim 15 further including a recycling station for recycling fluids and shelf life extending materials applied at the cleaning station and the application station.

22. An agricultural harvesting apparatus as in claim 15 wherein the unloading station further includes a packaging station suitable for the unloading of the cored produce product from the cushioned produce holders and packaging the produce product.

23. The agricultural harvesting apparatus of claim 15, wherein the coring stations comprise coring and topping stations suitable for both coring and topping the produce product so that the produce product has a cored portion and a cut top portion; and

wherein the application station is suitable for applying shelf life extending materials onto cored portions of the produce product and onto the cut top portion of the produce product.

24. An agricultural harvesting apparatus of claim 23, wherein the cushioned produce holders of the conveyor system are configured to hold the produce products such that produce product lies sideways on the conveyor system and

wherein the cored portion of the produce product points toward one side of the system and wherein the cut top of the produce product points toward another side of the conveyor system; and

wherein the application station is arranged so that the shelf life extending materials are applied from said sides of the conveyor system toward the produce product so that the are shelf life extending materials are applied onto cored portion of the produce product from the bottom of the produce product and applied onto the cut top of the produce product from the top of the top of the produce product.

25. The agricultural harvesting apparatus of claim 24, wherein the cushioned produce holders comprise cushioned paddles arranged in a spaced apart configuration such that produce products placed sideways on the conveyor system between the spaced apart paddles are held on the conveyor system oriented so that the cored portion of the produce product faces toward one side of the conveyor system and so that the cut top of the produce product faces toward another side of the conveyor system.

26. The agricultural harvesting apparatus of claim 25, wherein the produce product comprises romaine;

wherein the coring an topping station is suitable for coring and topping romaine;

wherein the cushioned paddles are suitable for holding cored and topped romaine so that the cored portion of the romaine faces toward one side of the conveyor system and the cut top of the romaine faces toward another side of the conveyor system; and

wherein the application station is arranged so that the shelf life extending materials are applied sideways onto the cored portion of the romaine and applied sideways onto the cut top portion of the romaine.

27. The agricultural harvesting apparatus of claim 15, wherein the produce product comprises harvested romaine and wherein the harvested romaine has been topped in the field;

wherein the coring stations core the topped romaine so that the romaine has a cored portion and a cut top portion; and

wherein the application station is suitable for applying shelf life extending materials onto cored portions of the romaine and onto the cut top portion of the romaine

28. An agricultural harvesting apparatus of claim 27, wherein the cushioned produce holders of the conveyor system are configured to hold the romaine on its side and wherein the cored portion of the romaine points toward one side of the system and wherein the cut top of the romaine points toward another side of the conveyor system; and

wherein the application station is arranged so that the shelf life extending materials are axially applied onto cored portion of the romaine and axially applied to the cut top of the romaine.

29. A produce harvesting apparatus comprising:

a conveyor system for conveying harvested produce between workstations, the conveyor system comprising a conveyor belt driven over rollers by a drive element and having a plurality of cushioned produce holders suitable for holding produce products in a desired orientation on the belt during operation;

a coring station suitable for accomplishing at least one of: coring the produce and topping the produce;

a loading station wherein the produce is loaded, having the desired orientation, onto the cushioned produce holders of the conveyor system;

an application station for applying shelf life extending materials onto at least one of a cored portion of the produce and a topped portion of the produce; and

an unloading station for removing the produce from the conveyor belt.

30. The apparatus of claim 29 wherein the conveyor belt has a plurality of openings formed therein enabling excess moisture to drain off the produce and the belt.

31. The apparatus of claim 29 wherein the cushioned produce holders of the conveyor belt comprise a plurality of cushioned paddles suitable for holding produce products in a desired orientation on the belt during operation.

32. The apparatus of claim 31 wherein the produce products comprise romaine.

33. The apparatus of claim 32 wherein the coring station is suitable for both coring and topping the romaine;

wherein cushioned paddles are configured such that romaine that has been both topped and cored can be placed between the cushioned paddles so that a cored end of the romaine faces one side of the conveyor belt and the topped end of the romaine faces another side of the conveyor belt; and

wherein the application station axially applies the shelf life extending materials from the top of the romaine onto the topped portion of the romaine and axially applies the shelf life extending materials from the bottom of the romaine onto the cored portion of the romaine.

34. The apparatus of claim 29 wherein the cushioned produce holders of the conveyor belt comprise a plurality of cushioned pads suitable for holding produce products on the conveyor belt so that the cored portion of the produce products face upward; and

wherein the application station is configured such that the shelf life extending material is applied downward onto the upward facing cored portions of the produce product.

35. The apparatus of claim 34 wherein the produce products comprise lettuce.

36. The apparatus of claim 35 wherein the cushioned pads comprise annular cushioned pads having a center portion configured so that cored lettuce can be placed in the center portion of the cushioned pads oriented with the cored portion of the lettuce facing upward and wherein the lettuce is held in this orientation until removed.

37. The apparatus of claim 29 further including a cleaning station for cleaning the conveyor system and the cushioned produce holders.

38. The apparatus of claim 37 further including a drying station for drying excess moisture off the produce product after they have been treated in the application station.

39. The apparatus of claim 38 further including a recycling station for recycling fluids and shelf life extending materials applied at the cleaning station and the application station.

40. The apparatus of claim 29 wherein the unloading station further includes a packaging station suitable for the unloading of the cored produce product from the cushioned produce holders and packaging the produce product.

41. A coring station for removing a core portion of a produce product, the coring station comprising:

a base board, suitable for having placed thereon produce products;

a coring blade shaped for cutting away a core portion of a produce product placed on the base board; and

a blade mount configured so that the coring blade can be adjustably positioned in order to achieve a desired cut on the produce product in order to cut away a core portion of the produce product.

42. The coring station of claim 41 further including a backing board positioned so that when a core end of a produce product is placed against the backing board a cut made with the coring blade achieves a desired cut on the produce product and cuts away a core portion of the produce product.

43. The coring station of claim 42

wherein the coring blade includes a knife portion attached to a shaft having a handle and a recoil mechanism;

wherein the blade mount includes a series of openings that lie a progressively greater distances from the backing board;

wherein the shaft passes through one of the series of openings enabling the alignment of the coring blade with the produce product, such alignment enabling the coring blade to achieve a desired cut on the produce product when the coring blade is depressed toward the base board cutting through the produce product to cut away a desired amount of the core portion of the produce product; and

wherein the recoil mechanism is configured to push the coring blade away from the base board once the produce product is cut.

44. The coring station of claim 42 wherein the coring station enables the coring of harvested romaine having a core portion and an outer leafy portion; and

wherein the coring blade is a U-shaped blade to enable a greater portion of core portion of the romaine to be cut away while leaving a greater portion of the outer leafy portion of the romaine in place on the head of romaine.

45. The coring station of claim 42 wherein the coring station enables the coring of harvested romaine having a core portion and an outer leafy portion; and

wherein the coring blade is a truncated V-shaped blade to enable a greater portion of core portion of the romaine to be cut away while leaving a greater portion of the outer leafy portion of the romaine in place on the head of romaine.

46. The coring station of claim 42 wherein the coring station enables the coring of harvested romaine having a core portion and an outer leafy portion; and

wherein the coring blade is a V-shaped blade to enable a greater portion of core portion of the romaine to be cut away while leaving a greater portion of the outer leafy portion of the romaine in place on the head of romaine.

47. A coring and topping station for removing a top portion and bottom core portion of a produce product, the coring station comprising:

a mount positioned such that a produce product can be conveyed through the station; and

a pair of substantially parallel blades positioned in the mount at a predetermined distance from each other so that said blades can cut away a top portion and a bottom portion of a produce product conveyed into the station.

48. A coring blade for using in cutting produce products, the coring blade comprising:

a knife portion attached toward one end of a shaft, the knife portion being configured to cut away an increased proportion of the core portion of the produce product and cut away a decreased portion of the outer portion of the produce product while making a straight cut through the produce product with the coring blade;

a handle attached to another end of the shaft; and

a recoil mechanism mounted with the shaft.

49. The coring blade of claim 48 wherein the knife portion of the coring blade is U-shaped blade thereby enabling an increased proportion of the core portion of the produce product while cutting away a decreased portion of the outer portion of the produce product while making a straight cut through the produce product with the coring blade.

50. The coring blade of claim 48 wherein the knife portion of the coring blade is truncated V-shaped blade thereby enabling an increased proportion of the core portion of the produce product while cutting away a decreased portion of the outer portion of the produce product while making a straight cut through the produce product with the coring blade.

51. The coring blade of claim 48 wherein the knife portion of the coring blade is V-shaped blade thereby enabling an increased proportion of the core portion of the produce product while cutting away a decreased portion of the outer portion of the produce product while making a straight cut through the produce product with the coring blade.

52. A method for harvesting produce comprising:

harvesting lettuce;

performing at least one of coring and topping the lettuce;

loading the lettuce onto the cushioned produce holders of a conveyor system;

holding the lettuce in the cushioned produce holders of the conveyor system;

conveying the lettuce with the conveyor system to an application station;

applying shelf life extending materials onto the lettuce, wherein the shelf life extending materials are applied onto a cored portion and a topped portion of the lettuce;

unloading the lettuce from the cushioned produce holders; and

packaging the lettuce.

53. The method of claim 52, further including cleaning the conveyor system and the cushioned produce holders.

54. The method of claim 52, further including drying excess moisture off the lettuce after they have had shelf life extending materials applied.

55. The method of claim 54, further includes recycling fluids and the shelf life extending materials applied during the applying and cleaning steps.

56. The method of claim 52,

wherein performing at least one of coring and topping the lettuce comprises coring lettuce to remove a portion of the core from the bottom of the lettuce;

wherein loading comprises loading the lettuce onto the cushioned produce holders of the conveyor system so that a cored bottom of the lettuce faces upward; and

wherein applying the shelf life extending materials comprises applying the shelf life extending materials downward onto the cored bottom of the lettuce.

57. The method of claim 56, wherein holding the lettuce in the cushioned produce holders of the conveyor system comprises holding the lettuce so that a cored bottom of the lettuce faces upward in an annularly shaped cushioned holding pad.

58. The method of claim 52,

wherein performing at least one of coring and topping the lettuce comprises coring and topping romaine lettuce to remove a portion of the core from the bottom of the romaine and a portion of the top of the romaine;

wherein loading comprises loading the romaine onto the cushioned produce holders of the conveyor system so that a romaine lies on its side and wherein the cored bottom of the romaine faces toward one side edge of the conveyor system and wherein the top portion of the romaine faces toward another side edge of the conveyor system; and

wherein applying the shelf life extending materials comprises axially applying the shelf life extending materials from the top of the romaine onto the top portion of the romaine and axially applying the shelf life extending materials from the bottom of the romaine onto the cored portion of the romaine.

59. The method of claim 58, wherein holding the romaine in the cushioned produce holders of the conveyor system comprises holding each head of romaine between two cushioned holding paddles.

* * * * *

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Brown et al.

(10) **Patent No.: US 6,298,865 B1**
(45) **Date of Patent: *Oct. 9, 2001**

(54) **APPARATUS AND METHODS FOR WASHING THE CORED AREAS OF LETTUCE HEADS DURING HARVEST**

(76) Inventors: **Richard S. Brown**, 34325 Chualar Canyon Rd., Chualar, CA (US) 93925; **Eugene D. Rizzo**, 90 Glen Lake Dr., Pacific Grove, CA (US) 93950

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

This patent is subject to a terminal disclaimer.

(21) Appl. No.: **09/295,438**

(22) Filed: **Apr. 20, 1999**

(51) **Int. Cl.**[7] **B08B 3/02**

(52) **U.S. Cl.** ..... **134/25.3**; 134/22.1; 134/22.18; 134/22.19; 134/23; 134/133; 134/166 R; 134/169 R; 134/62; 134/83; 134/72; 134/68; 134/126; 134/131; 426/324; 426/334; 426/335; 426/392; 426/442

(58) **Field of Search** ..... 134/22.1, 22.18, 134/22.19, 23, 25.3, 133, 166 R, 169 R, 62, 83, 72, 68, 126, 131; 426/324, 334, 335, 392, 442

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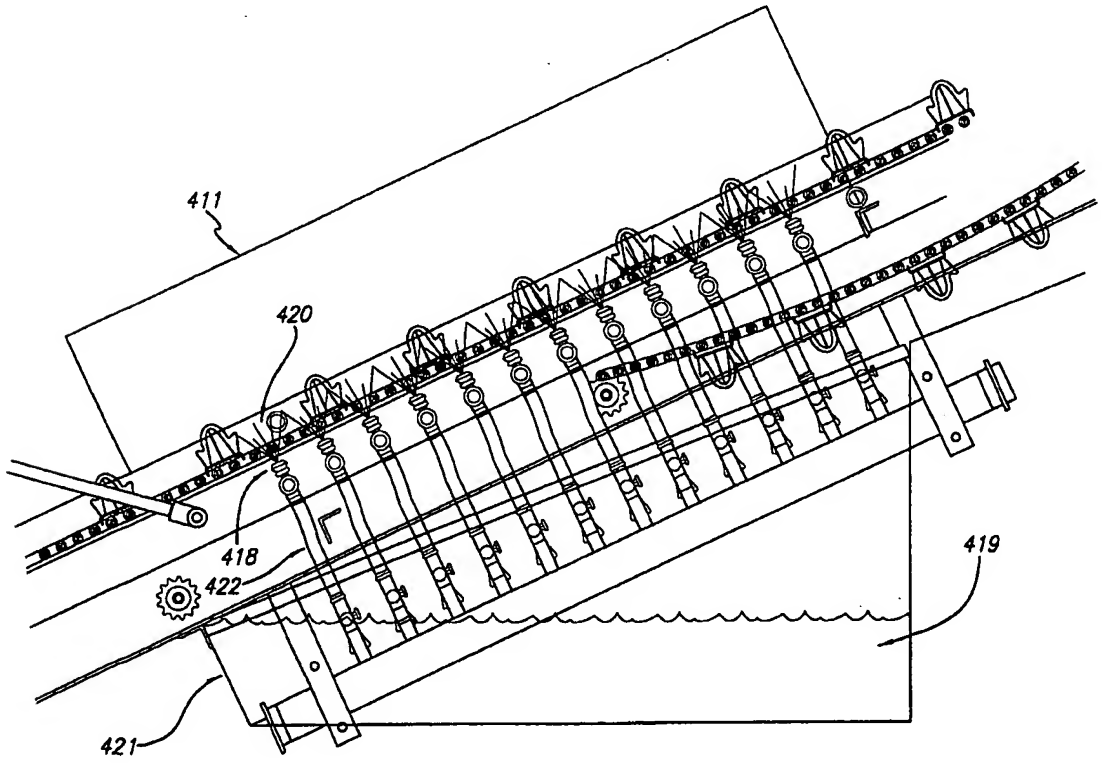
Primary Examiner—Sharidan Carrillo

(57) **ABSTRACT**

An apparatus and method for washing a plurality of cored lettuce heads as they are harvested in the field is disclosed. The apparatus incorporates a multi-segment hinged conveyer forming a loop, at least one support platform having an opening, at least one lettuce head guide connected to the support platform and an aqueous solution spraying system. Workers harvest lettuce heads, core the lettuce heads and then place them on the lettuce head guides which are moving along the conveyer. The lettuce heads are conveyed to an aqueous solution spraying system which washes the cored areas of the lettuce heads. The lettuce heads are then removed from the conveyer into a produce bin.

11 Claims, 8 Drawing Sheets



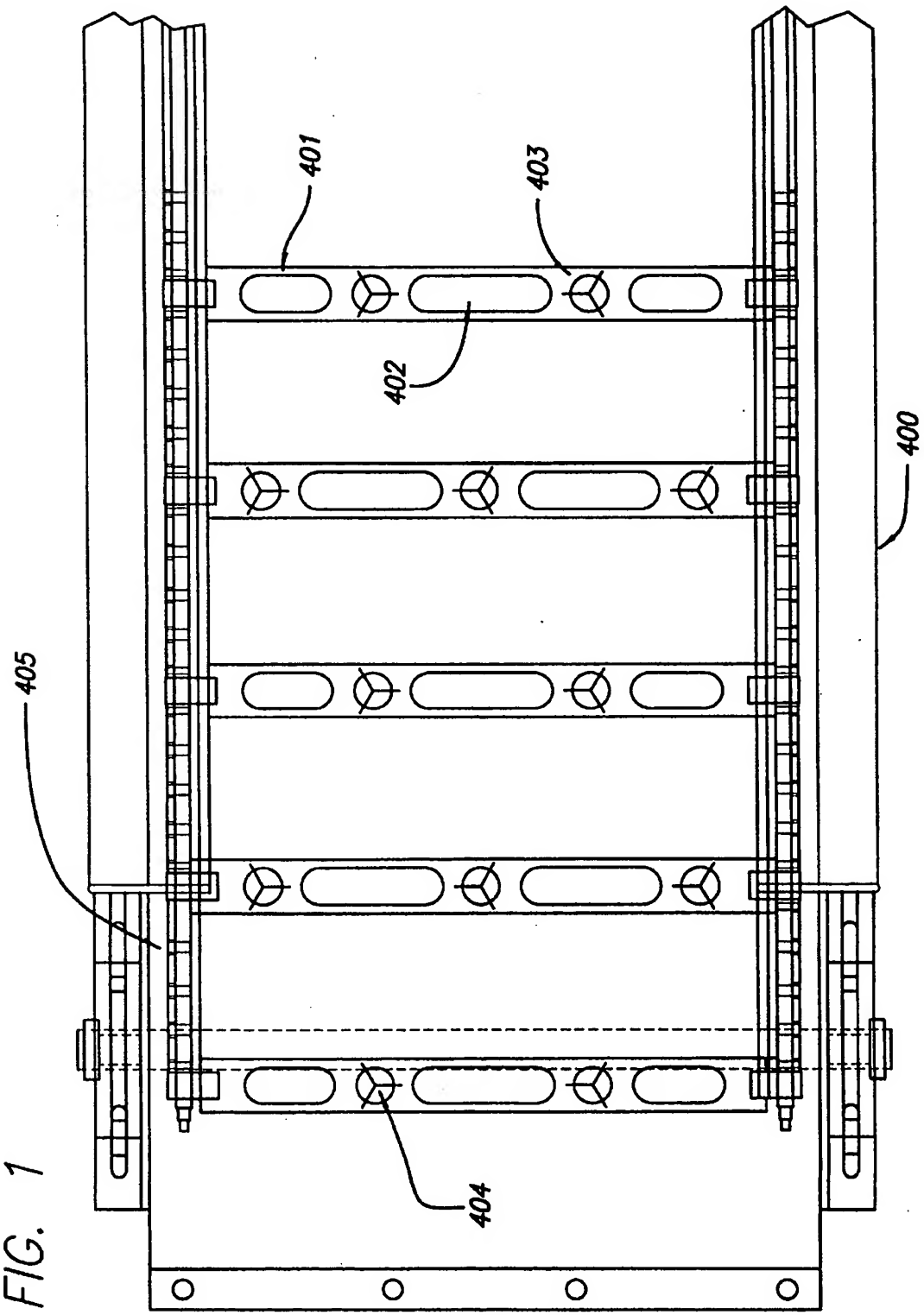


FIG. 1

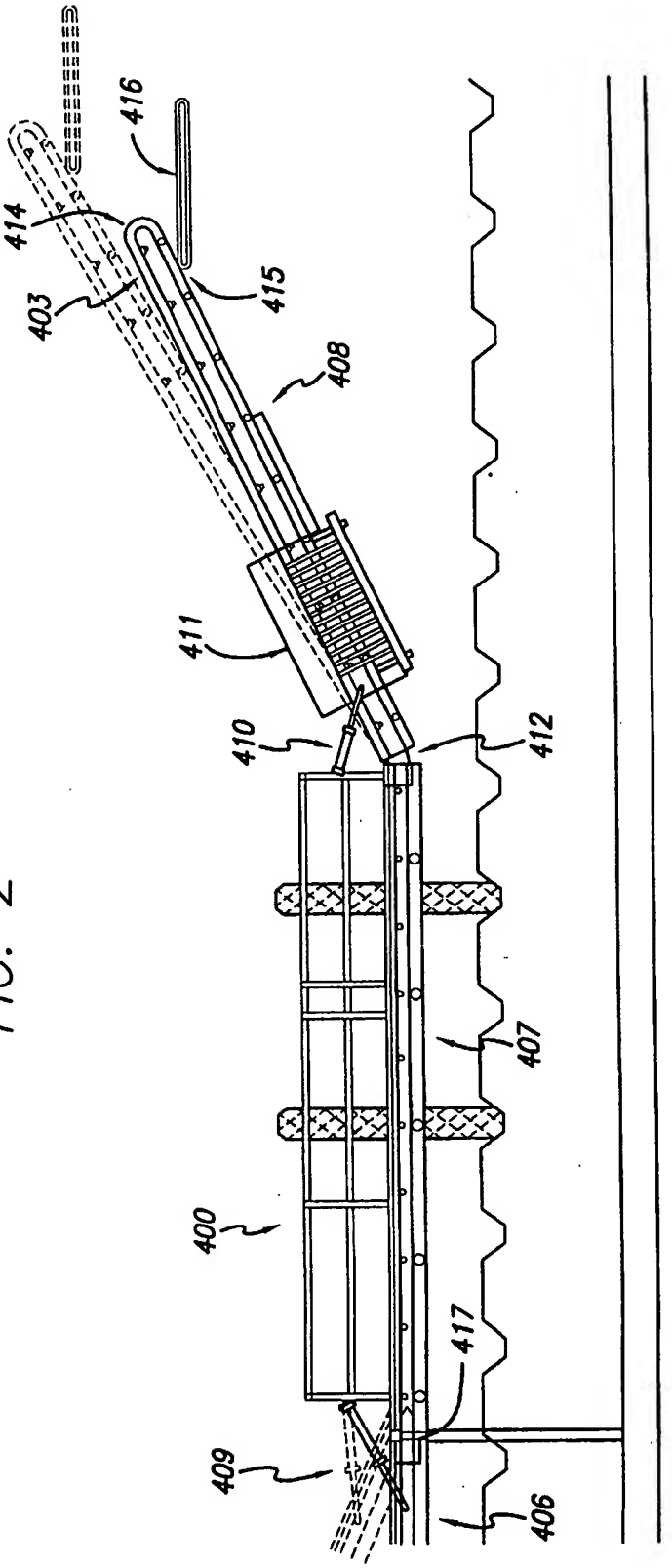


FIG. 2

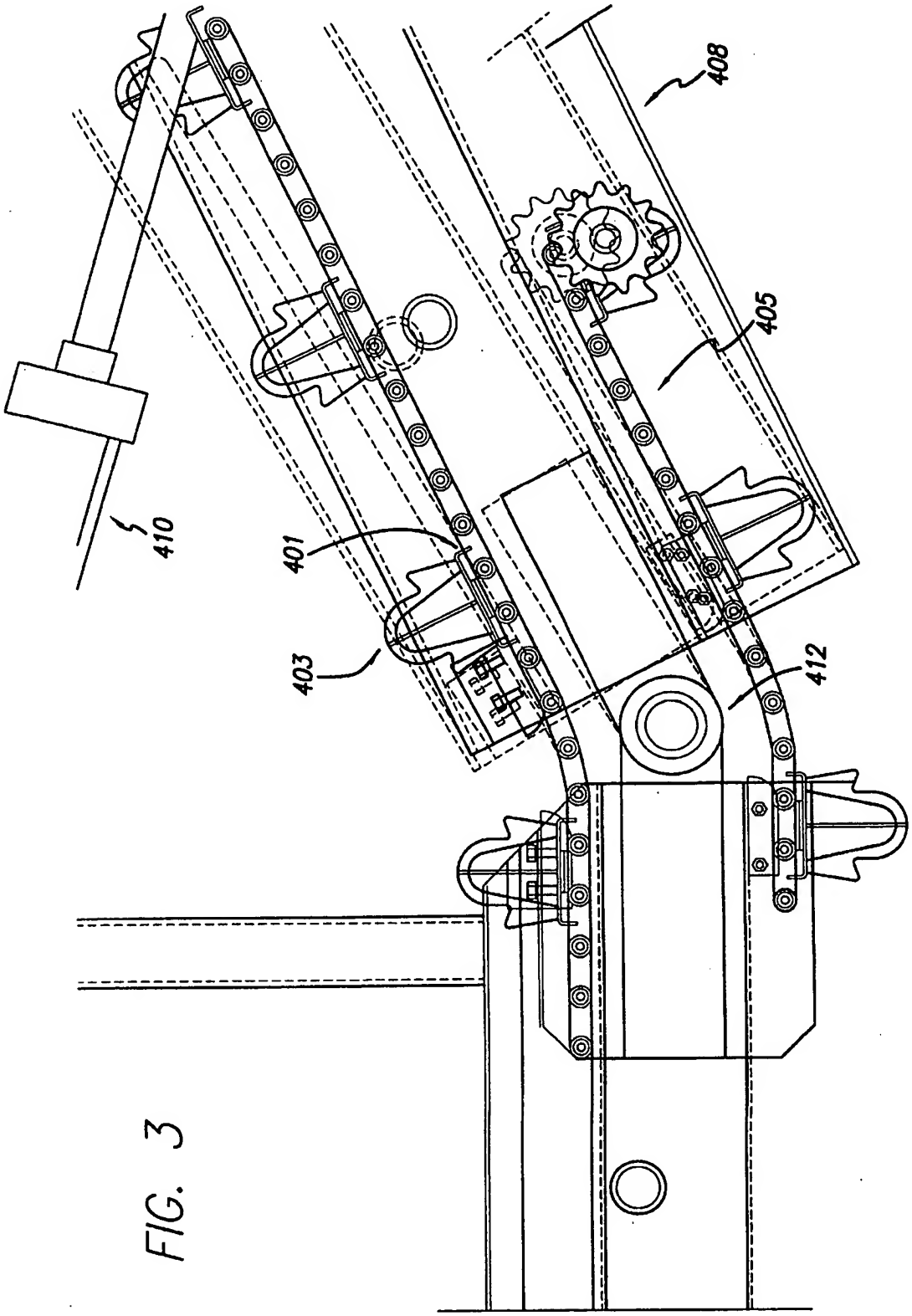


FIG. 3

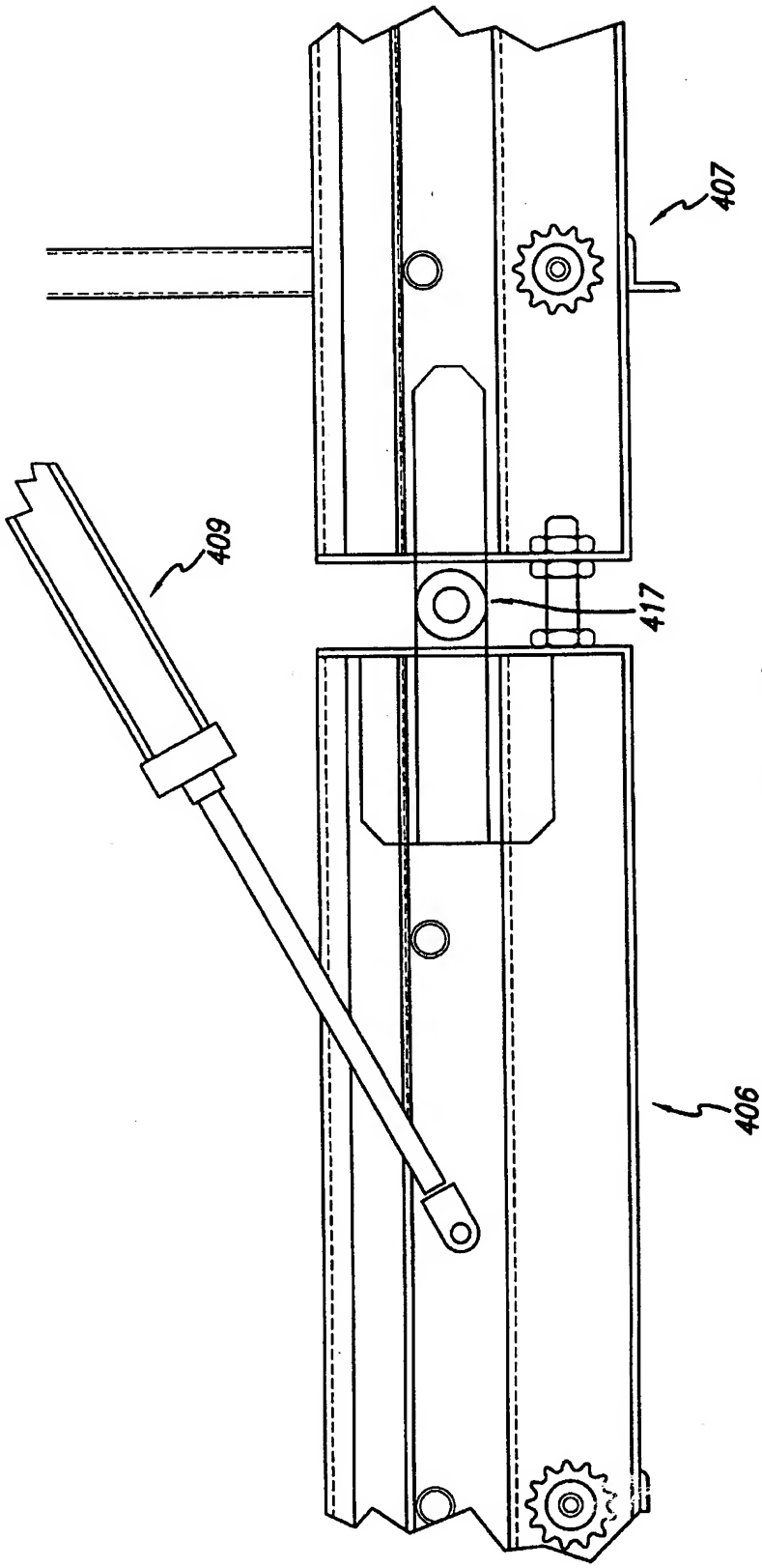


FIG. 4

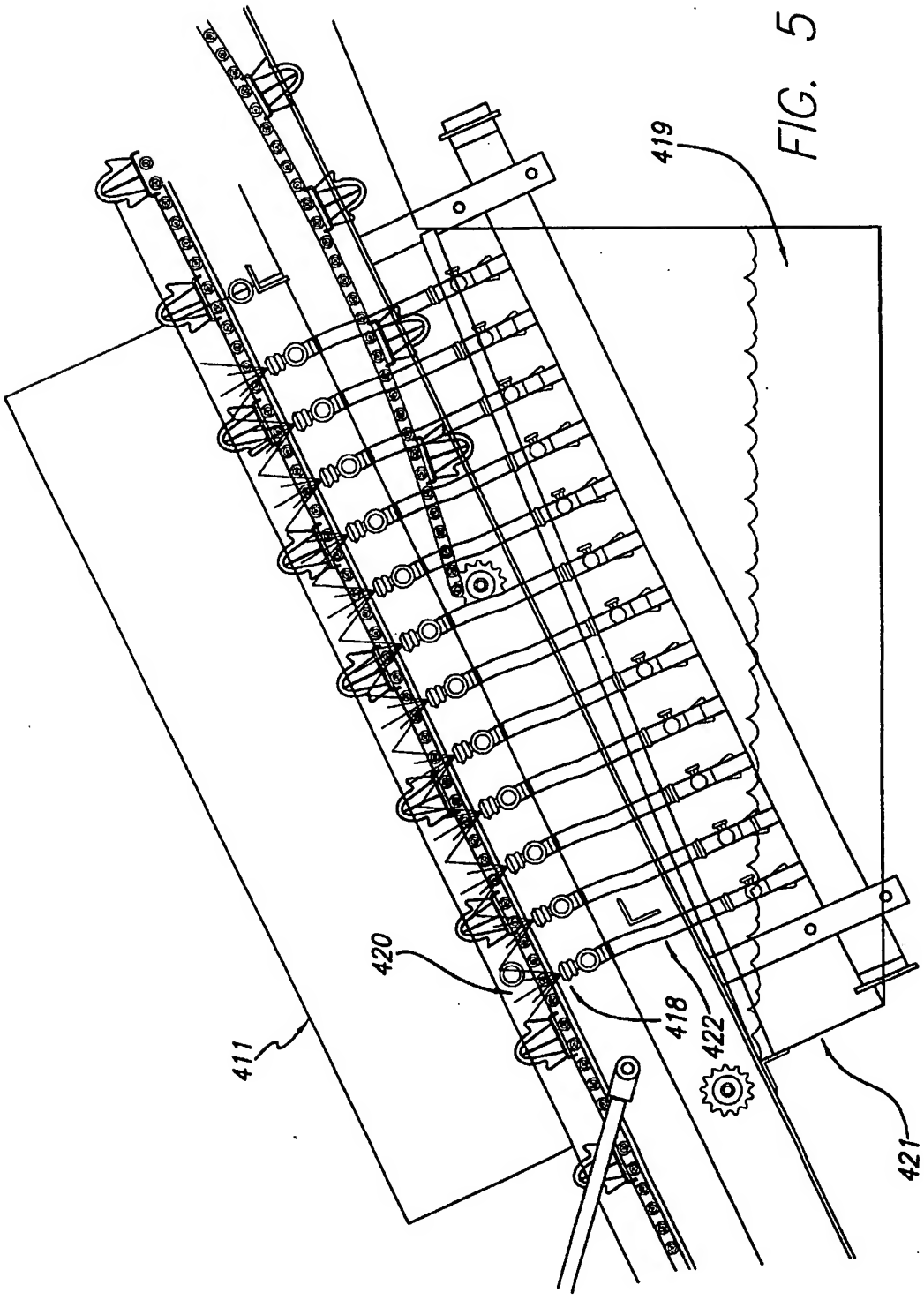


FIG. 5

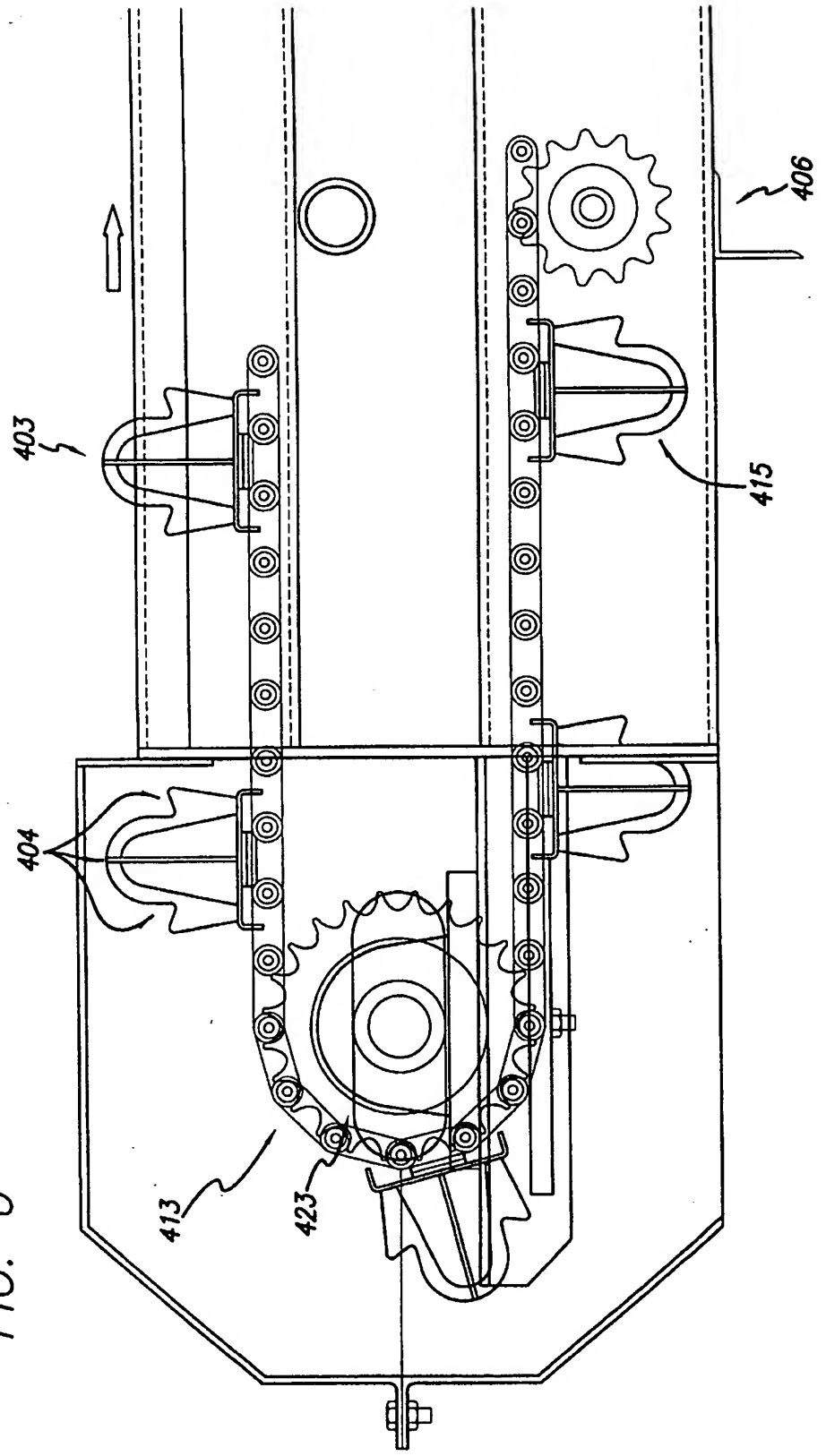


FIG. 6

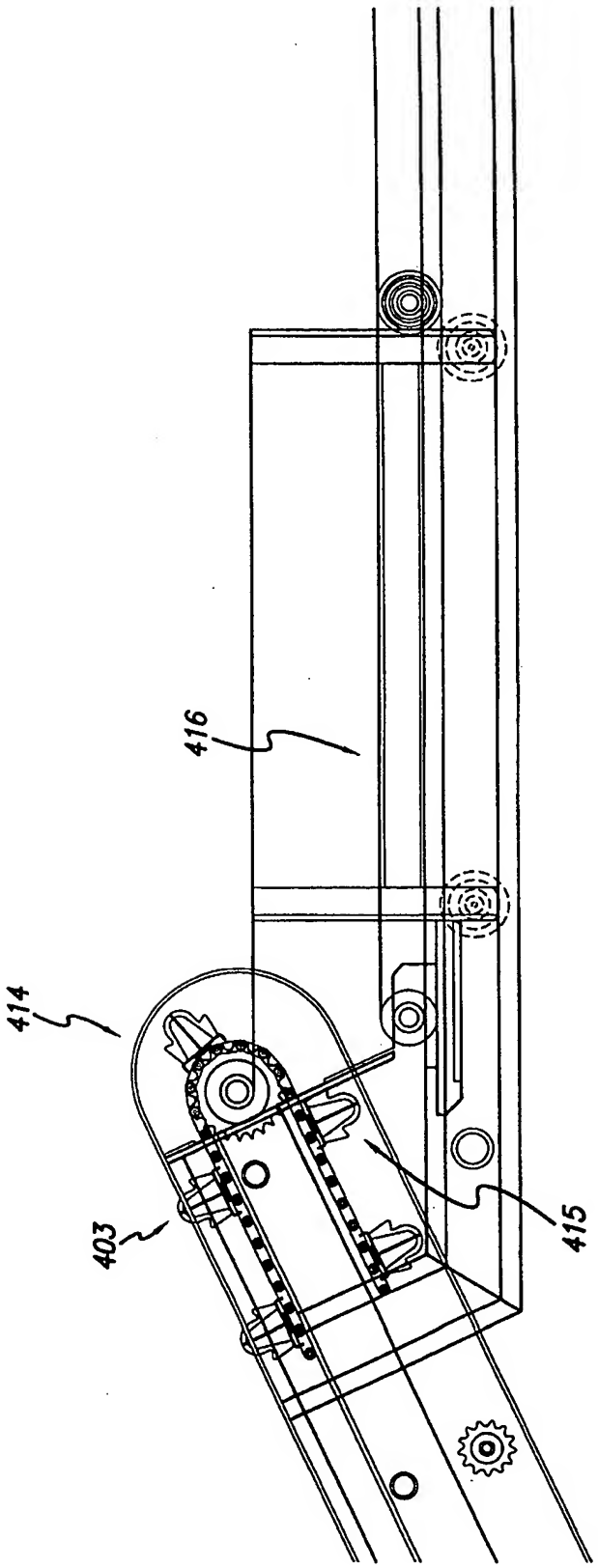


FIG. 7

FIG. 9

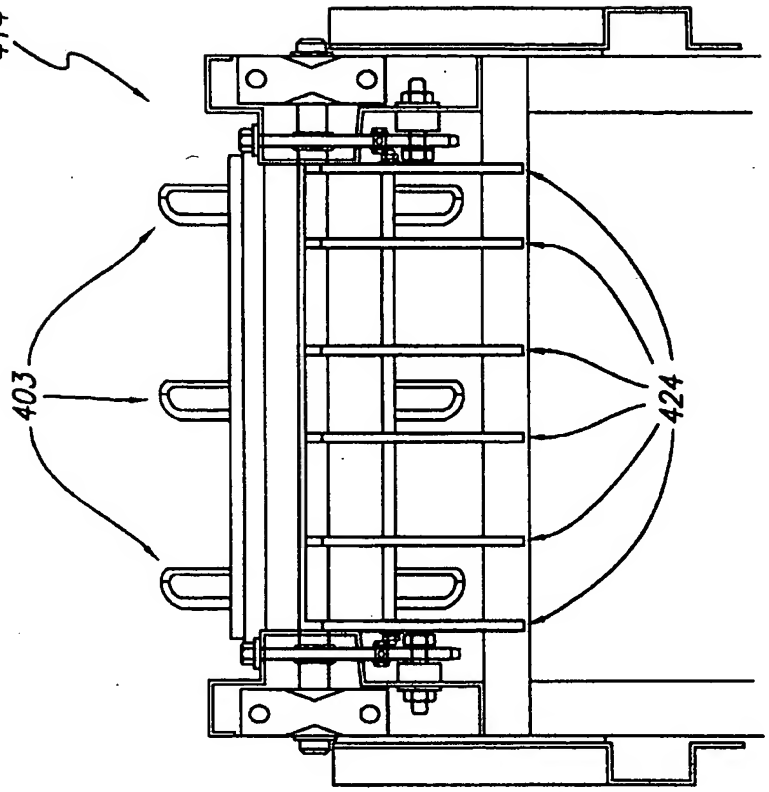
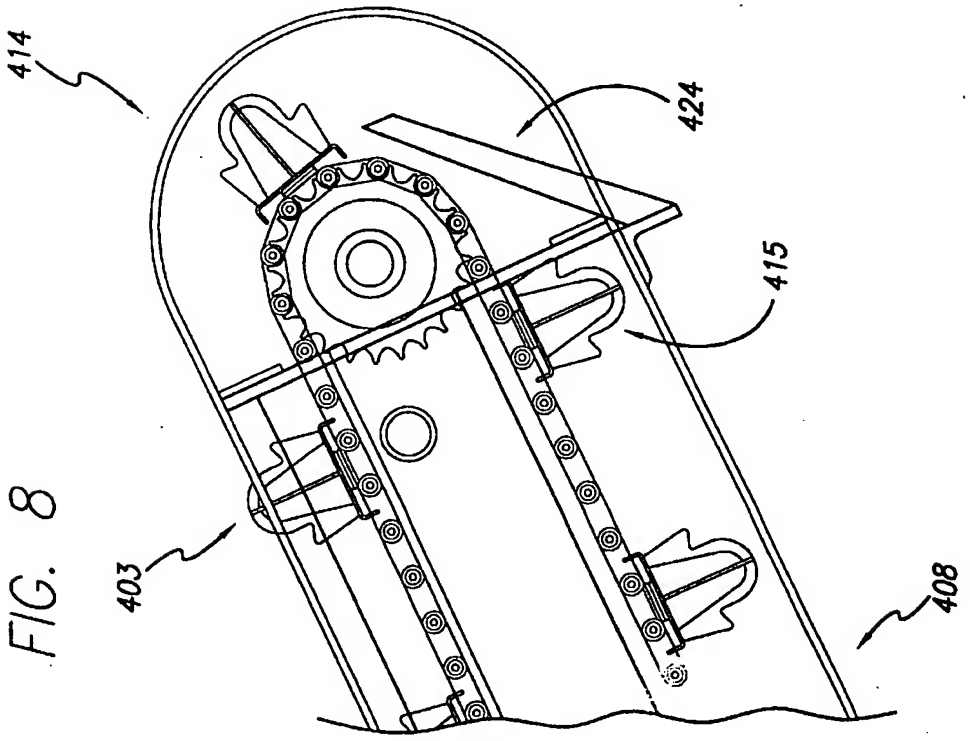


FIG. 8



APPARATUS AND METHODS FOR WASHING THE CORED AREAS OF LETTUCE HEADS DURING HARVEST

BACKGROUND OF THE INVENTION

This invention relates to apparatus and methods for washing the cored area of a lettuce head.

The field to which the invention relates is that of agricultural equipment and methods used in harvesting operations.

BRIEF SUMMARY OF THE INVENTION

The invention is an apparatus and method for washing a plurality of cored lettuce heads as they are harvested in the field. The apparatus comprises a conveyer forming a loop, support platforms attached to the conveyer with at least one lettuce head guide connected to each support platform, and an aqueous solution spraying system fixedly attached at a point along said conveyer loop. The claimed method involves the steps of placing at least one cored lettuce head onto a conveyer, conveying the lettuce head(s) to an aqueous solution spraying system, delivering an aqueous solution into the core hole(s) of the lettuce head(s) for a time and at a pressure sufficient to wash the core hole(s), and removing the cored lettuce head(s) from the conveyer.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a side elevation view of the apparatus for washing the cores of cored lettuce attached to a tractor.

FIG. 2 shows a top plan view of a section of the apparatus of FIG. 1.

FIG. 3 is an exploded side elevation view in cross section of the hinged area connecting the middle and proximal end segments of the apparatus shown in FIG. 1.

FIG. 4 is an exploded side elevation view in cross section of the hinged area connecting the central and distal end segments of the apparatus shown in FIG. 1.

FIG. 5 is a side elevation view in cross section of the wash chamber in the apparatus of FIGS. 1–4.

FIG. 6 is an exploded side elevation view in cross section of the unhinged end of the distal end segment in the apparatus of FIGS. 1–5.

FIG. 7 is an exploded side elevation view in cross section of the unhinged end of the proximal end segment in the apparatus of FIG. 6.

FIG. 8 is an exploded side elevation view in cross section of the unhinged end of the proximal end segment in the apparatus of FIG. 6 showing a removal finger.

FIG. 9 is an end view of the unhinged end of the proximal end segment showing the removal fingers.

DETAILED DESCRIPTION OF THE INVENTION

FIG. 1 shows an embodiment of washing apparatus **400** which includes three hinged sections—a distal end segment **406**, a middle segment **407**, and a proximal end segment **408**. Lifting cylinders **409** and **410**, powered and controlled hydraulically, rotate distal end segment **406** and proximal end segment **408** to desired angles of inclination. See FIGS. **3** and **4** for an example. Washing chamber **411** is located on proximal end segment **408** adjacent to connecting hinge **412**.

FIG. **2** shows lettuce head washing apparatus **400** as viewed from above. Apparatus **400** includes at least one support platform **401** which includes a plurality of openings

402. Platforms **401** support and are connected to guides **403**. Guides **403** orient the lettuce heads so that the aqueous solution is delivered to the core holes of the lettuce heads. In FIG. **2**, a preferred embodiment of guide **403** is shown as including three L-shaped vanes **404**, that project upwardly from platforms **401**. Guides **403** may also be circular, posts, spikes, or any other suitable holder used to support and orient the lettuce heads.

Platform **401** is attached at each end to a double pitch chain **405** that forms a loop. Preferably, apparatus **400** includes a plurality of support platforms **401**, each with at least two guides **403**, attached at intervals along chain **405**, such as shown in FIG. **2**. In some embodiments platforms **401** are detachable from chain **405**. The combination of guides **403**, platforms **401**, chains **405** and associated frame and driving mechanisms form a looped belt, sometimes called a harvester belt, that moves along an elliptical or other path. Sprockets **423**, as shown for example in FIG. **6**, are powered and controlled hydraulically to move chain **405**, thereby moving attached platforms **401** and connected guides **403**. Preferably the belt is attached, at one end, to a hitch of a puller vehicle e.g. a tractor of **40** horse power or greater.

Guides **403** are conveyed in a substantially upright position from unhinged end **413** of distal end segment **406** towards unhinged end **414** of proximal end segment **408**. In a preferred embodiment distal end segment **406** is maintained in a horizontal and co-linear position with middle segment **407** during operation. Workers place cored heads of lettuce on guides **403** as they traverse distal end segment **406** and central segment **407** in an upright position. Cored lettuce heads on guides **403** then travel through wash chamber **411** to unhinged end **414** of proximal end segment **408**.

FIG. **5** shows wash chamber **411**. Wash chamber **411** includes one or more spray nozzles **418** that continually spray or otherwise deliver an aqueous lettuce head washing solution **419** into the core holes of the lettuce heads as they travel over nozzles **418**. Solution **419** is pumped to nozzles **418** through hoses **422** from supply tank **421** located below wash chamber **411**. Solution **419** may be pumped by any suitable pump. Preferred embodiments use a centrifugal pump powered and controlled hydraulically. Solution **419** emerges from nozzles **418** under pressure and travels upward as spray **420** through openings in platforms **401** into the core holes of lettuce heads. Solution **419** which drains from the lettuce is collected, filtered, and recycled by supply tank **421**. A preferred embodiment of supply tank **421** used to collect, filter and recycle solution **419** is disclosed in the currently pending U.S. patent application Ser. No. 09/144, 972 filed Sep. 1, 1998 by applicants Richard S. Brown and Eugene D. Rizzo. That application is hereby incorporated by reference.

The level of solution in supply tank **421** is kept at a predetermined level by a float valve. Supply tank **421** may be connected to a tractor mounted nurse tank. Aqueous solution **419** may be pumped from the nurse tank to supply tank **421** by any pump. Preferred embodiments use a cents gal pump, powered and controlled hydraulically.

In some embodiments, a single lettuce head passes over one or more nozzles **418**, repeatedly washing the core hole. Nozzles **418** may deliver washing solution **419** at either high pressure and low volume, or low pressure and high volume. Preferred embodiments include both types of nozzles **418**.

After exiting washing chamber **411**, the lettuce heads are conveyed to unhinged end **414** of proximal end segment **408**. Proximal end segment **408** is preferably elevated, as

shown in FIG. 1, at an inclination angle of 25–35 degrees. The washed lettuce heads will thereby be elevated for deposit onto a conveyer or into produce bins. At unhinged end **414** the cored lettuce heads on guides **403** are rotated through an angle to a substantially inverted position **415**, as shown, for example, in FIG. **7**. In inverted position **415** the cored lettuce heads detach from guide **403**. At least one fixed removing finger **424**, as shown, for example, in FIGS. **8** and **9**, placed adjacent to unhinged end **414** may be used to assist in unseating the lettuce heads. Inverted guides **403** return to unhinged distal end **413** of the harvester belt. There guides **403** rotate through an angle to a substantially upright position. For an example, see FIG. **6**. Guide **403** then travels back towards proximal end **408** of the harvester belt for receipt of additional cored lettuce heads to be washed.

What is claimed is:

1. A method for washing at least one head of lettuce with a cored hole comprising the steps of:

placing said at least one cored lettuce head in a position such that the cored hole faces substantially downward;

after said placing step, conveying said at least one cored lettuce head to an aqueous solution spraying system;

delivering an aqueous solution from said aqueous solution spraying system into said cored hole for a time and at a pressure sufficient to wash said cored hole; and

removing said at least one cored lettuce head from said position.

2. The method of claim **1** wherein said placing step comprises seating said cored lettuce head on a guide which has a first opening for said aqueous solution to pass through, said guide being attached to a support platform which has at least a second opening.

3. The method of claim **1** wherein said step of delivering an aqueous solution into said cored hole further comprises using:

a tank containing said aqueous solution;

at least one spray nozzle communicating with said tank; and

a pump communicating with said tank to deliver said aqueous solution to said at least one spray nozzle.

4. The method of claim **1** wherein said aqueous solution spraying system comprises a fist nozzle and a second nozzle and wherein said first nozzle sprays said aqueous solution at first pressure and a first volume, and where said second nozzle sprays said aqueous solution at a second pressure and a second volume.

5. The method of claim **1** wherein the step of removing said at least one lettuce head further comprises using at least one removing finger device.

6. The method of claim **2** wherein said conveying step comprises conveying said guide along a path forming a loop.

7. The method of claim **3** wherein said at least one spray nozzle sprays said aqueous solution at a first pressure and a first volume.

8. The method of claim **3** comprising the further steps of collecting, filtering, and recycling said aqueous solution which drains from said lettuce heads.

9. The method of claim **3** comprising the further step of maintaining a level of said aqueous solution in said tank at a predetermined level.

10. The method of claim **6** wherein said path forming a loop has a distal end, and a proximal end, such that said guide is conveyed in a substantially upright position from said distal end to said proximal end.

11. The method of claim **10** wherein said proximal end is elevated in relation to said distal end.

* * * * *

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(54) SYSTEMS AND METHODS FOR HARVESTING FRESH PRODUCE

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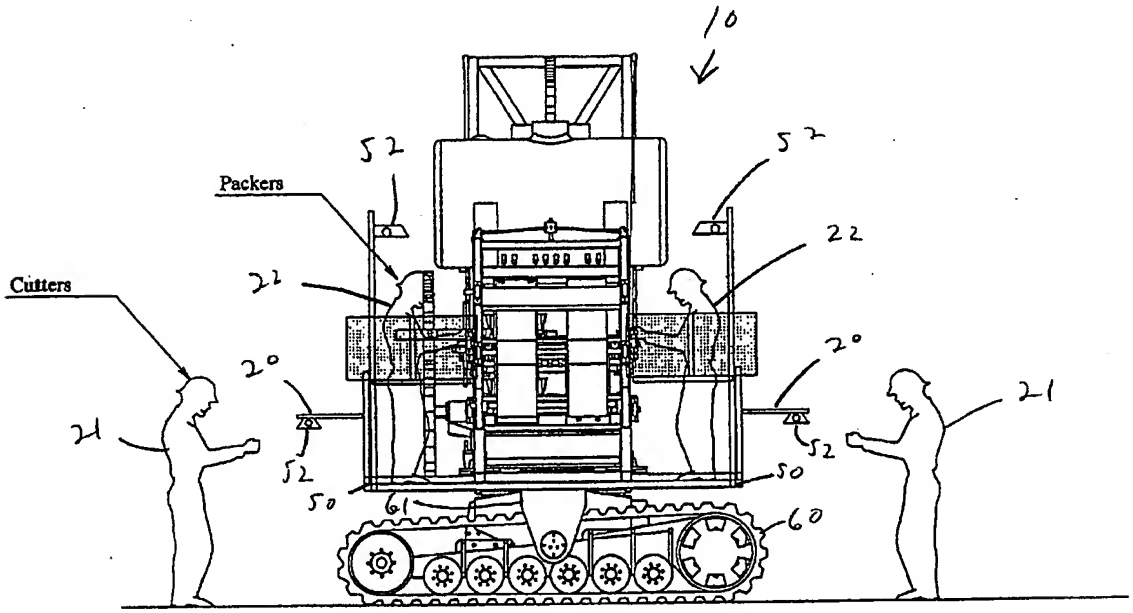
(57) ABSTRACT

Systems and methods for harvesting fresh produce using a produce harvesting apparatus wherein the method includes trimming the fresh produce and placing the trimmed produce into a container. The container is placed onto a transport device located on the produce harvesting apparatus. The container is then transported on the transport device to a wash station and it is washed at the wash station. The container may be shaken during transport after the wash station.



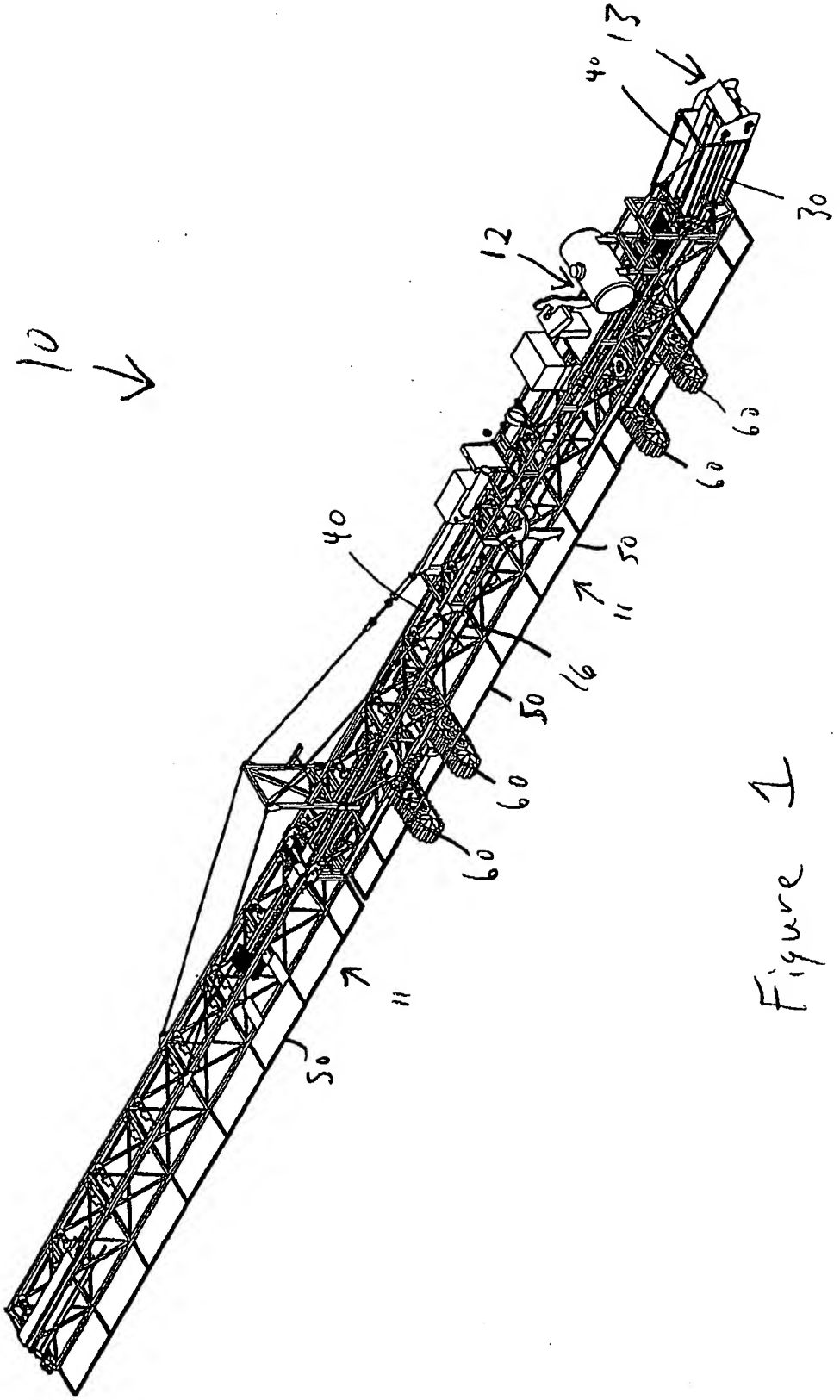


Figure 1

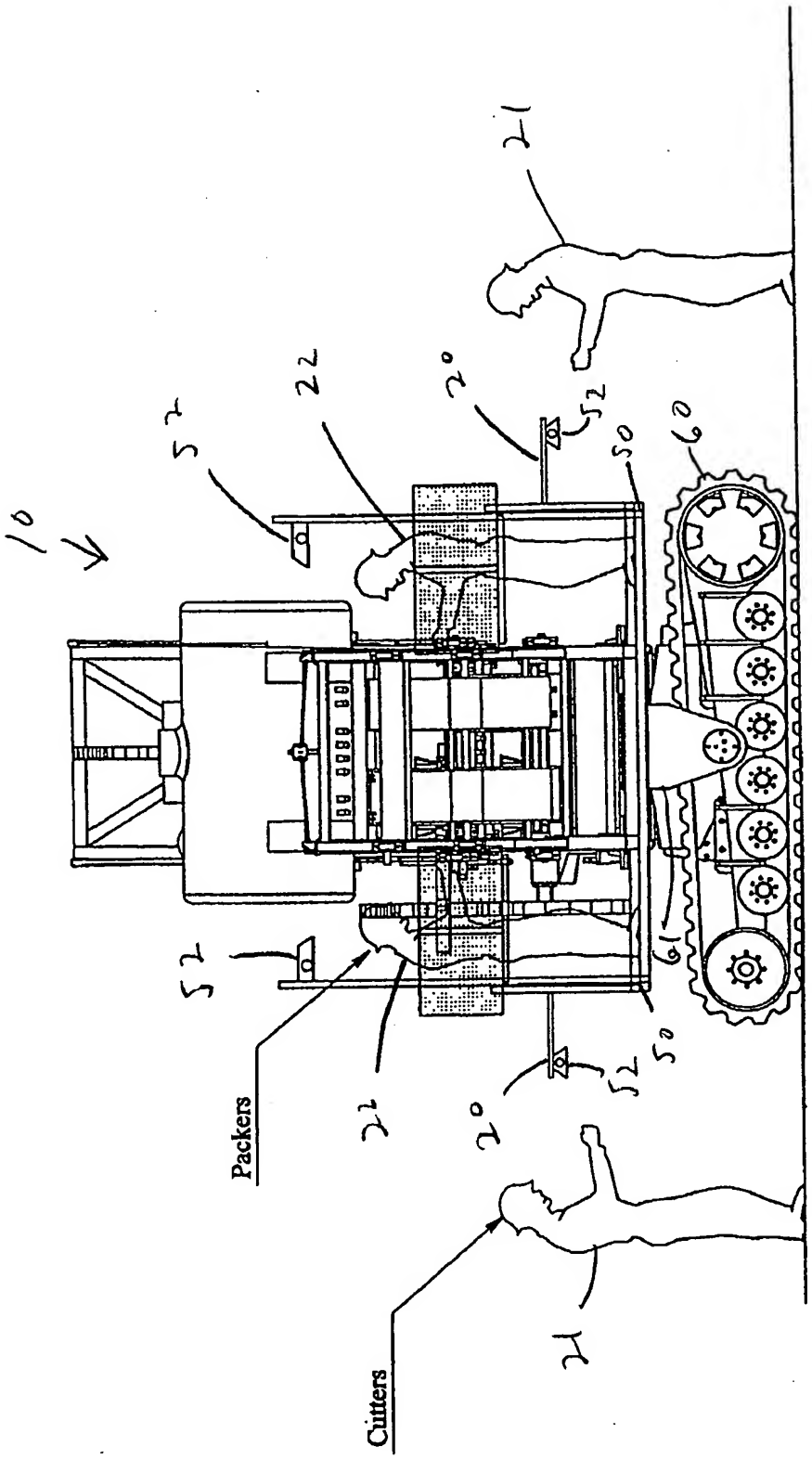


Figure 2

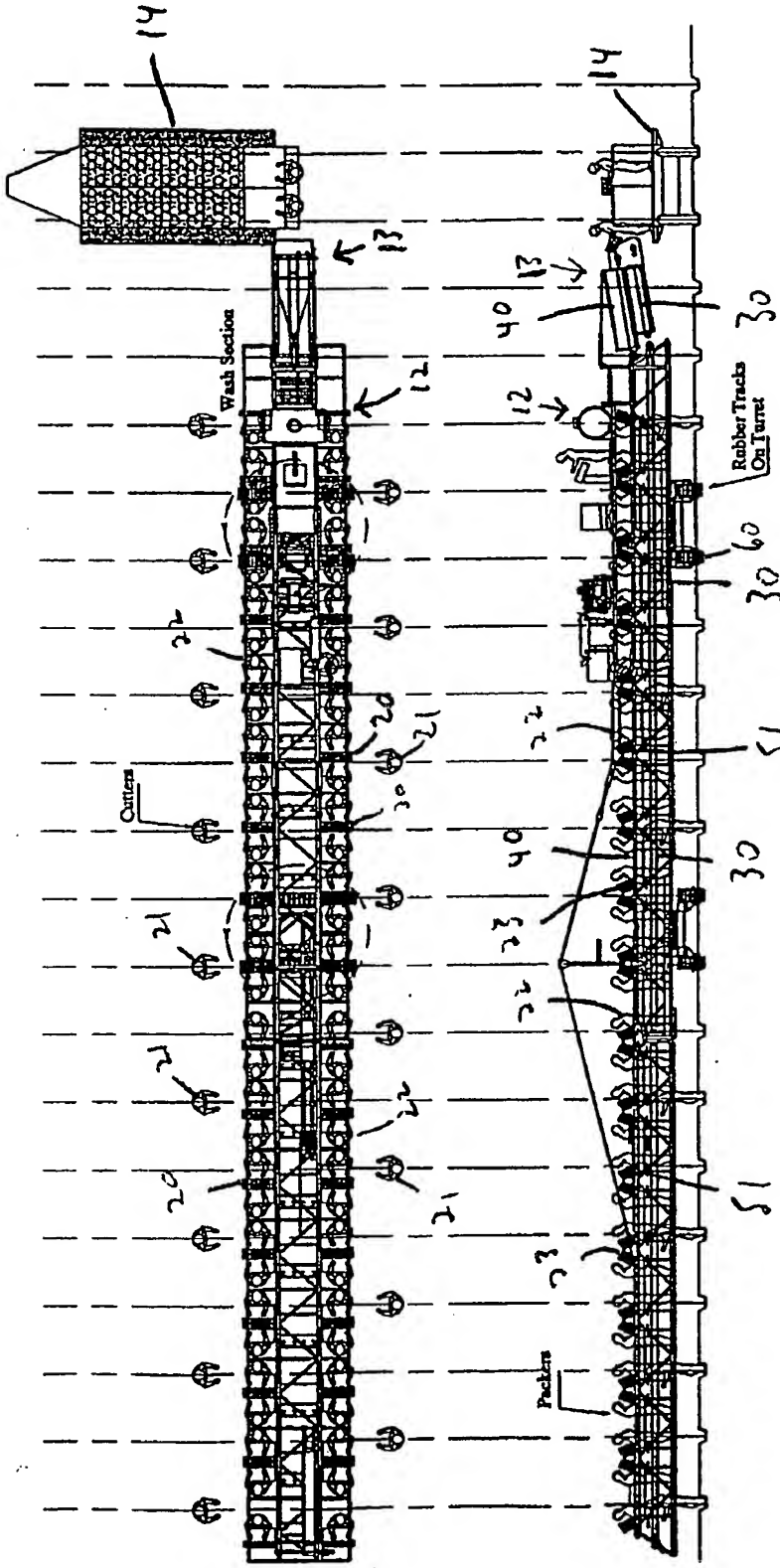


Figure 4

Figure 3

Figure 5

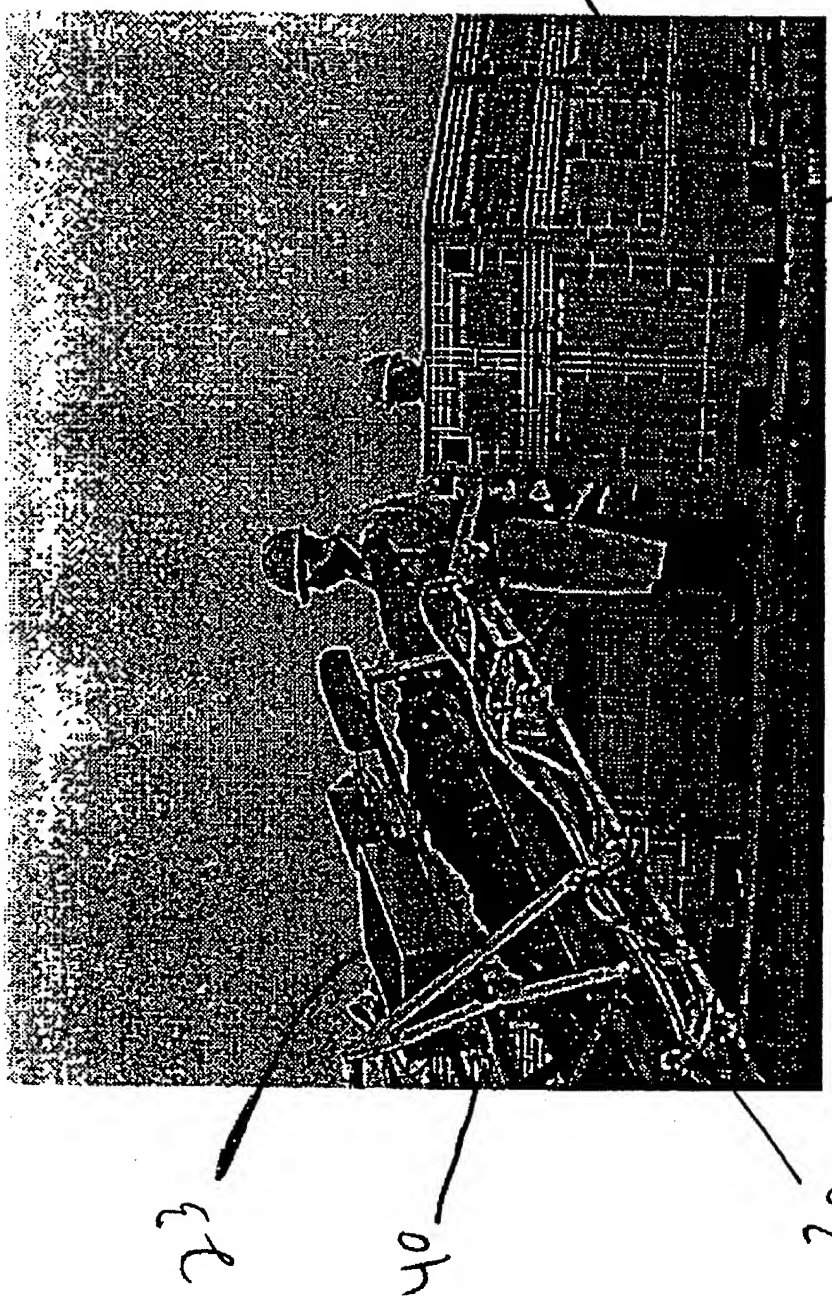


Figure 6

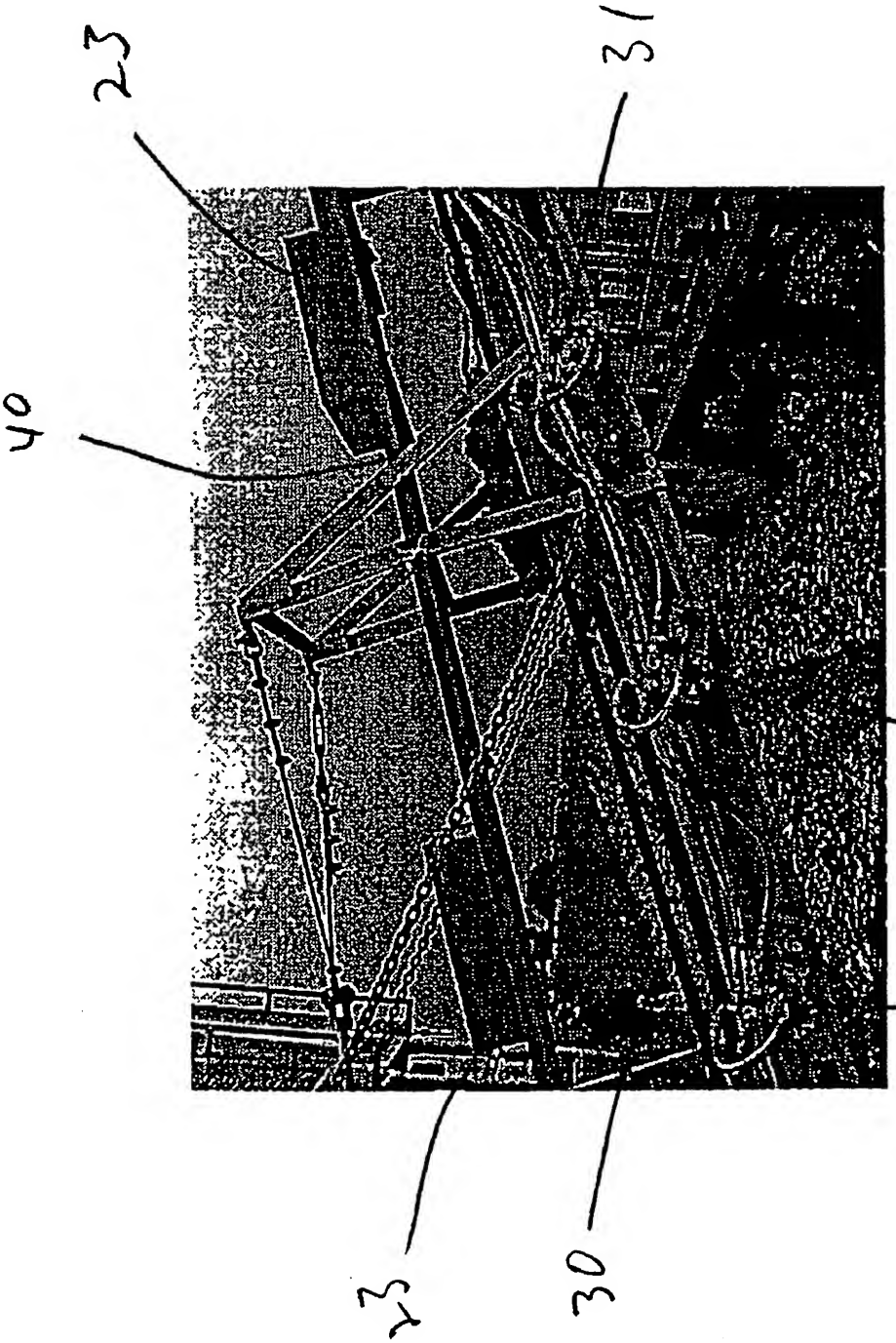


Figure 7

SYSTEMS AND METHODS FOR HARVESTING FRESH PRODUCE

CROSS-REFERENCES TO RELATED APPLICATIONS

[0001] This application is a continuation-in-part application and claims the benefit of Application No. 09/507,503, entitled "Method For Processing Freshly Harvested Leavy Vegetables And Subdivided, Peeled Fruit", which disclosure is incorporated herein by reference for all purposes.

STATEMENT AS TO RIGHTS TO INVENTIONS MADE UNDER FEDERALLY SPONSORED RESEARCH OR DEVELOPMENT

[0002] Not applicable

REFERENCE TO A "SEQUENCE LISTING," A TABLE, OR A COMPUTER PROGRAM LISTING APPENDIX SUBMITTED ON A COMPACT DISK.

[0003] Not applicable

BACKGROUND OF THE INVENTION

[0004] 1. Field of the Invention

[0005] The present invention relates to systems and methods for harvesting fresh produce, and more particularly, to systems and methods using a harvesting apparatus for harvesting lettuce-type produce wherein the lettuce-type produce is trimmed and cored in the field.

[0006] 2. Description of the Prior Art

[0007] The demand for leafy vegetables, such as, for example, lettuce, spinach, cabbage, baby leaves, baby lettuce, baby spinach, frisee, flowering kale, kale, cilantro, baby leaf vegetables, arugula, etc., has greatly increased over the years. Salads are now often in high demand for meals, whether as an entree, a side dish or an appetizer. Thus, lettuce is generally grown and harvested year-round in various parts of the United States. Furthermore, with the increased demand comes an increased need for efficiency in order to quickly and adequately meet the demand.

[0008] Many produce companies, especially salad producing companies, desire to produce high quality field-cored lettuce, especially romaine lettuce, for shipment to their regional salad plants. Coring the lettuce in the field eliminates most waste leaves and cores thereby reducing the bulkiness of the product during shipment. Generally, this means that only 100 percent usable lettuce leaves are shipped when the lettuce head is cored in the field.

[0009] It has been discovered by the present assignee that it is preferable to first cut and core the romaine lettuce heads and then allow them to bleed excess sap prior to washing. The sap, or latex exudate, generally requires from one to four minutes to adequately bleed, depending upon weather conditions, time of day, etc.

[0010] An initial attempt at providing a system and method for trimming and coring romaine lettuce while harvesting involved cutting and coring romaine lettuce and then placing the heads into a tray affixed to the harvesting apparatus. The tray included a wire bottom. A first tray is filled and then the packer begins filling a second tray that is also affixed to the harvesting apparatus. When the second tray is filled, the first tray is washed and then dumped by tipping the tray over onto a conveyor belt. The trimmer then starts refilling the first tray. Thus, a tray always is full and left to wait while another tray is being filled. This created a delay for the latex to exude from the romaine leaf veins. However, this arrangement is inefficient with regard to labor. Each tray is washed by the trimmer prior to dumping. This results in lost trimming time of approximately 16 percent.

SUMMARY OF THE INVENTION

[0011] The present invention provides a method of harvesting fresh produce using a produce harvesting apparatus wherein the method includes trimming the fresh produce and placing the trimmed produce into a container. The container is placed onto a transport device located on the produce harvesting apparatus. The container is then transported on the transport device to a wash station and it is washed at the wash station.

[0012] In accordance with one aspect of the present invention, the trimmed produce is transported on the transport device from the wash station to a transport container. The trimmed produce is transferred from the trimmed produce to the transport container.

[0013] In accordance with another aspect of the present invention, the transport device is shaken at least between the wash station and the transport container.

[0014] In accordance with a further aspect of the present invention, the transport device comprises a conveyor and the conveyor is shaken by clapper bars located under the conveyor that thereby bounce the conveyor.

[0015] In accordance with another aspect of the present invention, the transport device is shaken between where the container is placed thereon and the transport container.

[0016] In accordance with a further aspect of the present invention, the container is placed on a return transport located on the produce harvesting apparatus and transported thereon.

[0017] In accordance with yet another aspect of the present invention, the container comprises a tote with a wire mesh bottom.

[0018] In accordance with yet a further aspect of the present invention, the container comprises a plastic tote with a grid bottom that allows liquid to penetrate through the bottom of the tote after washing the trimmed produce.

[0019] In accordance with yet another aspect of the present invention, the container comprises a basket.

[0020] In accordance with a further aspect of the present invention, the container comprises a wire basket.

[0021] In accordance with yet another aspect of the present invention, the wash station comprises spray nozzles.

[0022] In accordance with yet a further aspect of the present invention, the trimmed produce is submerged at the wash position.

[0023] In accordance with another aspect of the present invention, the container includes a solid bottom.

[0024] In accordance with a further aspect of the present invention, the trimmed produce is washed by filling the container with liquid and then dumping or draining out the liquid.

[0025] The present invention also provides a portable produce harvesting system that includes at least one trim station for trimming produce, at least one container for receiving trimmed produce, at least one wash station for washing trimmed produce in the container, and at least one transport device coupling the trim station and the wash station.

[0026] In accordance with one aspect of the present invention, the system further comprises a load station after the wash station for receiving washed produce. The transport device extends between the trim station and the load station.

[0027] In accordance with another aspect of the present invention, the system includes structure for shaking the transport device at least between the wash station and the load station.

[0028] In accordance with another aspect of the present invention, the system includes a plurality of trim stations.

[0029] In accordance with a further aspect of the present invention, the system includes a plurality of containers.

[0030] Thus, the present invention provides systems and methods for harvesting produce, especially lettuce, such as romaine lettuce, wherein the produce is trimmed, which may include coring, in the field. Trimmed produce is placed within a container and then placed on a transport device for transport to a wash station. While the container is being filled, the sap is allowed to bleed from the trimmed produce. Additionally, sap further bleeds from the produce while it is being transported to the wash station. Additionally, a first container may be allowed to sit before being placed on the transport device, while a second container is filled. Once the second container is filled, the first container may be placed on the transport device and transported to the wash station. The delay time in allowing the first container to sit provides extra time for the sap to bleed from the trimmed produce.

[0031] Additionally, the transport device may extend between the wash station and a transport container and may be shaken to help shake excess water and any remaining sap from the trimmed produce. Additionally, the transport device may be shaken between the trim stations and the wash station in order to help remove sap bleeding from the trimmed produce.

[0032] The preferred exemplary embodiments of this invention will now be discussed in detail. These embodiments depict the novel and nonobvious systems and methods for harvesting fresh produce of this invention shown in the accompanying drawings, which are included for illustrative purposes only, with like numerals indicating like elements.

BRIEF DESCRIPTION OF THE DRAWINGS

[0033] **FIG. 1** is a perspective view of a produce harvesting apparatus in accordance with the present invention;

[0034] **FIG. 2** is an end elevation view of the produce harvesting apparatus illustrated in **FIG. 1**;

[0035] **FIG. 3** is a side elevation view of the produce harvesting apparatus illustrated in **FIG. 1**;

[0036] **FIG. 4** is a top plan view of the produce harvesting apparatus illustrated in **FIG. 1**;

[0037] **FIG. 5** is a close-up view of a possible wash station for the produce harvesting apparatus illustrated in **FIG. 1**;

[0038] **FIG. 6** is a close-up view of a possible load station for the produce harvesting apparatus illustrated in **FIG. 1**; and

[0039] **FIG. 7** is a close-up view of part of possible transport devices for the produce harvesting apparatus illustrated in **FIG. 1**.

DETAILED DESCRIPTION OF THE INVENTION

[0040] FIGS. **1-4** illustrate a produce harvesting apparatus **10**. The apparatus is especially useful for harvesting leafy produce such as, for example, romaine lettuce. The apparatus includes at least one trim station **11** and at least one wash station **12**. Preferably, there are a plurality of trim stations. Additionally, in a preferred embodiment, a load station **13** is provided for transferring harvested produce to a transport apparatus **14** such as, for example, a truck or trailer. Preferably, the truck or trailer includes a plurality of bins **15** that are lined with polyethylene-based liner bags that receive the harvested produce. A transport device **16**, preferably in the form of a conveyor or conveyors, couples the trim station(s) and wash station.

[0041] Preferably, each trim station includes a space or platform **20** of some type for receiving harvested produce from a cutter **21**. The cutter cuts the produce from the field and preferably trims off waste leaves that are not desirable. The harvested produce is then placed on the platform. A packer **22** then receives the trimmed produce and places it into a container or tote **23** of some type. When the produce is of a type such as, for example, romaine lettuce, one of either the trimmer or packer trims out the core of the head or stalk of produce prior to placing it on the platform or in the container. Thus, as used herein, trimming refers to all types of actions with regard to modifying the harvested produce such as, for example, cutting off portions of the produce, removing a core from the produce, etc.

[0042] Once a container is filled with produce, it is preferably left to sit at the trim station while a second container is filled. This allows for sap (latex) to flow from the cut veins in instances when romaine lettuce is being harvested. Once the second container or tote is filled, the first tote is placed on the conveyor. The conveyor then transports the container to the wash station.

[0043] Preferably, the wash station includes a plurality of spray nozzles. The nozzles may be arranged in rows or any suitable arrangement that adequately washes the trimmed produce. Thus, preferably, spray nozzles are provided above and below the container so that some spray upwardly while others spray downwardly. Preferably, the transport device within the wash station consists of a conveyor or chain drive such that the totes that sit on the conveyor or chain drive may move through the wash station. Additionally, the wash station may be provided manually and thus, it would involve at least one person manually spraying the produce. Furthermore, the wash station may involve filling the containers with liquid and then dumping them, or may involve submerging the containers in liquid.

[0044] With reference to FIGS. 5-7, harvesting apparatus **10** includes a load station **13**, a transport device **30**, preferably in the form of another conveyor, moves the containers from the wash station to the load station. Transport devices **16** and **30** may be a single conveyor or multiple conveyors. Additionally, a separate transport device may be provided through the wash station, which is illustrated in **FIG. 5** with a chain drive. Thus, there may be a single conveyor, multiple conveyors and/or chain drives, in combination if desired, for transporting filled containers through harvesting apparatus **10**.

[0045] At the load station, at least one person preferably dumps the containers into transport bins that are contained on some sort of transport apparatus **14** such as a truck, trailer, tractor, etc.

[0046] In a preferred embodiment, transport device **30** between the wash station and the load station is configured to shake or vibrate, thus shaking or vibrating the containers thereon. This shakes excess water from the totes, and thus from the washed, trimmed produce therein. In one embodiment, a plurality of hydraulic motors **31** are provided in series, which power clapper bars under conveyor **30** in order to bounce the conveyor and thereby the containers. Additionally, transport apparatus **14** may simply include a storage area or bed to directly receive the produce, as opposed to the bins, due to a high volume of containers presented at the load station.

[0047] Once the containers have been emptied, a return transport device **40**, preferably in the form of a conveyor, is provided for returning empty containers to the trim stations.

[0048] In a preferred embodiment, each trim station includes an area **50** on which the packing person stands. Additionally, there are sections **51** for placing the containers while they are being filled and while they are waiting to be placed on the conveyor for transport to the wash station and load station. Additionally, the trim stations preferably include lights **52** so that if it is fairly dark, the cutters and packers may be able to see adequately.

[0049] In a preferred embodiment, harvesting apparatus **10** moves on rubber tracks **60** that are coupled to the apparatus with turrets **61**, thus allowing the harvesting apparatus to center itself with regard to rows of produce for harvesting in the field. Thus, each rubber track is between rows of produce so that they do not damage any of the produce. Additionally, one set of rubber tracks may pivot vertically and horizontally in order to level the harvesting apparatus.

[0050] Preferably, containers **23** comprise some type of tote that allows for liquid to drain through the bottom, as well as sap from the harvested produce. Examples of such containers include a tote with a wire mesh bottom, a basket, a wire basket, a plastic tote with one or more holes in the bottom or a grid-type bottom, and a tote with a solid bottom. If a container is used, the wash station may involve filling the container with a liquid and then dumping out the liquid.

[0051] Accordingly, in use, the harvesting apparatus is moved to a field of produce and is positioned so that its rubber tracks are between rows of produce. A motor provided on the harvesting device then starts moving the harvesting apparatus through the field of produce. The cutters are on either side of the harvesting apparatus and cut produce from the field. The cutters preferably trim off waste leaves, core heads from the produce, and cut any other undesired parts from the harvested produce and then place it on the platform at the trim station. The packer then places the trimmed produce into a container. Alternatively, the packer may do some or all of the trimming. Once a first container is filled, the packer begins filling a second container. This allows for sap to exude from the trimmed produce. Once the second container is filled, the first container is placed on the transport device and is transported to the wash station, where the trimmed produce is washed. Obviously, if there is no need or desire for delay, the filled containers may be placed on the conveyor immediately upon being filled.

[0052] After the trimmed produce is washed, the containers move along the transport device and are preferably shaken to remove excess water therefrom. Containers are then emptied into either transport bins or directly into a truck or trailer. Emptied containers are then placed on a return transport device so that they are returned to the trim stations.

[0053] Although the invention has been described with reference to specific exemplary embodiments, it will appreciated that it is intended to cover all modifications and equivalents within the scope of the appended claims.

What is claimed is:

1. A method of harvesting fresh produce using a produce harvesting apparatus, the method comprising:

trimming the fresh produce;

placing the trimmed produce into a container;

placing the container onto a transport device located on the produce harvesting apparatus;

transporting the container on the transport device to a wash station; and

washing the trimmed produce at the wash station.

2. A method in accordance with claim 1 further comprising transporting the trimmed produce on the transport device from the wash station to a transport container and transferring the trimmed produce to the transport container.

3. A method in accordance with claim 2 further comprising shaking the transport device at least between the wash station and the transport container.

4. A method in accordance with claim 3 wherein the transport device comprises a conveyor and the conveyor is shaken by clapper bars located under the conveyor to thereby bounce the conveyor.

5. A method in accordance with claim 3 wherein the transport device is shaken between where the container is placed thereon and the transport container.

6. A method in accordance with claim 1 further comprising placing the container onto a return transport located on the produce harvesting apparatus and transporting the container thereon.

7. A method in accordance with claim 1 wherein the container comprises a tote with a wire mesh bottom.

8. A method in accordance with claim 1 wherein the container comprises a plastic tote with a grid bottom that allows liquid to penetrate through the bottom of the tote after washing the trimmed produce.

9. A method in accordance with claim 1 wherein the container comprises a basket.

10. A method in accordance with claim 1 wherein the container comprises a wire basket.

11. A method in accordance with claim 1 wherein the wash station comprises spray nozzles.

12. A method in accordance with claim 1 comprising submerging the trimmed produce in a liquid at the wash station.

13. A method in accordance with claim 1 wherein the container includes a solid bottom.

14. A method in accordance with claim 13 where the trimmed produce is washed by filling the container with liquid and then dumping or draining out the liquid.

15. A method in accordance with claim 1 further comprising placing trimmed produce in a second container after a first container has been filled with trimmed produce, and then placing the first container on the transport device after the second container is filled.

16. A method of harvesting fresh produce using a produce harvesting apparatus, the method comprising:

trimming the fresh produce;

placing the trimmed produce into a container;

placing the container onto a conveyor located on the produce harvesting apparatus;

transporting the container on the conveyor to a wash station;

washing the trimmed produce at the wash station transporting the trimmed produce on the conveyor from the wash station to a transport container and transferring the trimmed produce to the transport container shaking the container at least between the wash station and the transport container.

17. A method in accordance with claim 16 wherein the shaking is accomplished by clapper bars located under the conveyor that bounce the conveyor and thereby shake the container.

18. A method in accordance with claim 16 wherein the container is shaken between where the container is placed on the conveyor and the transport container.

19. A method in accordance with claim 16 further comprising placing the container onto a return conveyor located on the produce harvesting apparatus and transporting the container thereon.

20. A method in accordance with claim 16 wherein the container comprises a tote with a wire mesh bottom.

21. A method in accordance with claim 16 wherein the container comprises a plastic tote with a grid bottom that allows liquid to penetrate through the bottom of the tote after washing the trimmed produce.

22. A method in accordance with claim 16 wherein the container comprises a basket.

23. A method in accordance with claim 16 wherein the container comprises a wire basket.

24. A method in accordance with claim 16 wherein the wash station comprises spray nozzles.

25. A method in accordance with claim 16 comprising submerging the trimmed produce in a liquid at the wash station.

26. A method in accordance with claim 16 wherein the container includes a solid bottom.

27. A method in accordance with claim 26 wherein the trimmed produce is washed by filling the container with liquid and then dumping or draining out the liquid.

28. A method in accordance with claim 16 further comprising placing trimmed produce in a second container after a first container has been filled with trimmed produce, and then placing the first container on the conveyor after the second container is filled.

29. A portable produce harvesting system comprising:

at least one trim station for trimming produce;

at least one container for receiving trimmed produce;

at least one wash station for washing trimmed produce in the container; and

at least one transport device coupling the trim station and the wash station.

30. A system in accordance with claim 29 further comprising a load station after the wash station for receiving washed produce, wherein the transport device extends between the trim station and the load station.

31. A system in accordance with claim 30 further comprising means for shaking the transport device at least between the wash station and the load station.

32. A system in accordance with claim 31 wherein the transport device comprises a conveyor and the means for shaking the transport device at least between the wash station and the load station comprise clapper bars under the conveyor.

33. A system in accordance with claim 30 further comprising means for shaking the transport device at least between the trim station and the load station.

34. A system in accordance with claim 33 wherein the transport device comprises a conveyor and the means for shaking the transport device at least between the trim station and the load station comprise clapper bars under the conveyor.

35. A system in accordance with claim 30 further comprising at least one return transport device between the load station and the trim station.

36. A system in accordance with claim 29 wherein the container comprises a tote with a wire mesh bottom.

37. A system in accordance with claim 29 wherein the container comprises a plastic tote with a grid bottom that allows liquid to penetrate through the bottom of the tote after washing the trimmed produce.

38. A system in accordance with claim 29 wherein the container comprises a basket.

39. A system in accordance with claim 29 wherein the container comprises a wire basket.

40. A system in accordance with claim 29 wherein the wash station comprises spray nozzles.

41. A system in accordance with claim 29 wherein the wash station submerges the trimmed produce in a liquid.

42. A system in accordance with claim 29 wherein the container includes a solid bottom.

43. A system in accordance with claim 29 wherein the system comprises a plurality of trim stations.

44. A system in accordance with claim 29 wherein the system comprises a plurality of containers.

45. A portable produce harvesting system comprising:

a plurality of trim stations for trimming produce;

a plurality of containers for receiving trimmed produce;

at least one wash station for washing trimmed produce in the containers;

a load station after the wash station for receiving washed produce; and

at least one conveyor coupling the trim stations and the load station.

46. A system in accordance with claim 45 further comprising means for shaking the conveyor at least between the wash station and the load station.

47. A system in accordance with claim 46 wherein the means for shaking the conveyor at least between the wash station and the load station comprise clapper bars under the conveyor.

48. A system in accordance with claim 45 further comprising means for shaking the conveyor at least between the trim stations and the load station.

49. A system in accordance with claim 48 wherein the means for shaking the conveyor at least between the trim stations and the load station comprise clapper bars under the conveyor.

50. A system in accordance with claim 45 further comprising at least one return transport device between the load station and the trim stations.

51. A system in accordance with claim 45 wherein the containers comprise totes with a wire mesh bottom.

52. A system in accordance with claim 45 wherein the containers comprise plastic totes with a grid bottom that allows liquid to penetrate through the bottom of the tote after washing the trimmed produce.

53. A system in accordance with claim 45 wherein the containers comprise baskets.

54. A system in accordance with claim 45 wherein the containers comprise wire baskets.

55. A system in accordance with claim 45 wherein the wash station comprises spray nozzles.

56. A system in accordance with claim 45 wherein the wash station submerges the trimmed produce in a liquid.

57. A system in accordance with claim 45 wherein each container includes a solid bottom.

* * * * *

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Garcia, Jr. et al.

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(54) **PRODUCE WASHING METHOD**

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(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

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(51) **Int. Cl.**[7] **B08B 3/02**
(52) **U.S. Cl.** **134/25.3**; 134/32; 134/131; 134/133
(58) **Field of Search** 134/25.3, 32, 10, 134/131, 133

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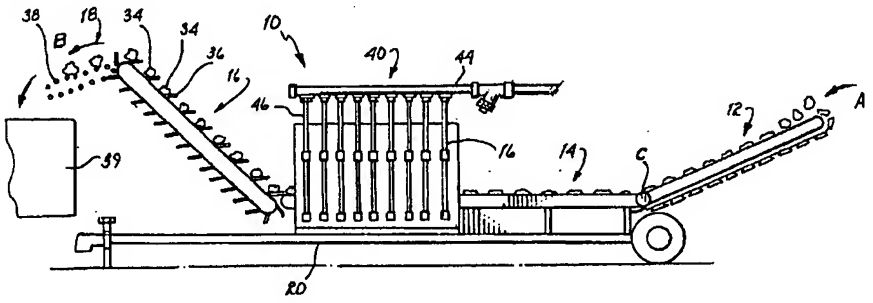
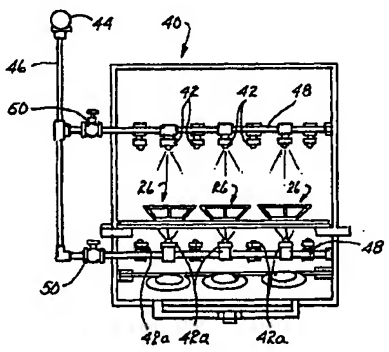
(57) **ABSTRACT**

A produce washing method, which permits the washing of produce from both above and below in the field. Produce is transported along a conveyor belt, from a loading section, to a washing section on which is located a washing unit, upward along an ascending section, and from there the produce travels along a dumping section and into a receptacle. The washing unit features spray nozzles located above and below the washing section, so as to direct spray from above and below the produce so as to more effectively wash it.

6 Claims, 2 Drawing Sheets





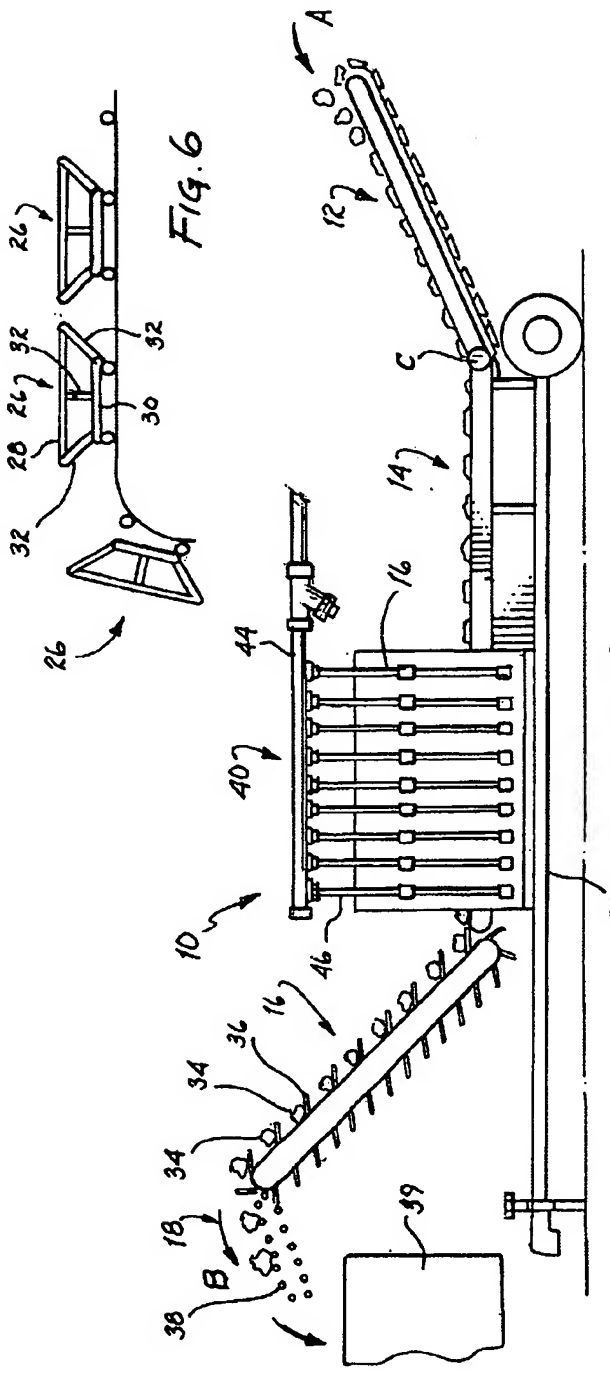


FIG. 1

FIG. 6

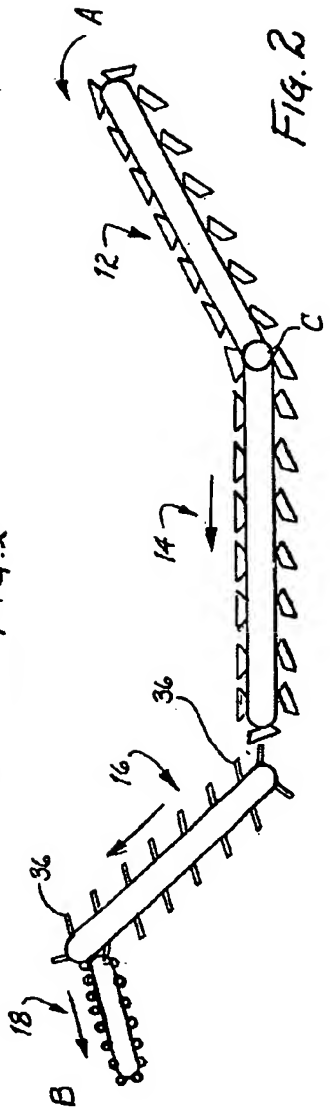


FIG. 2

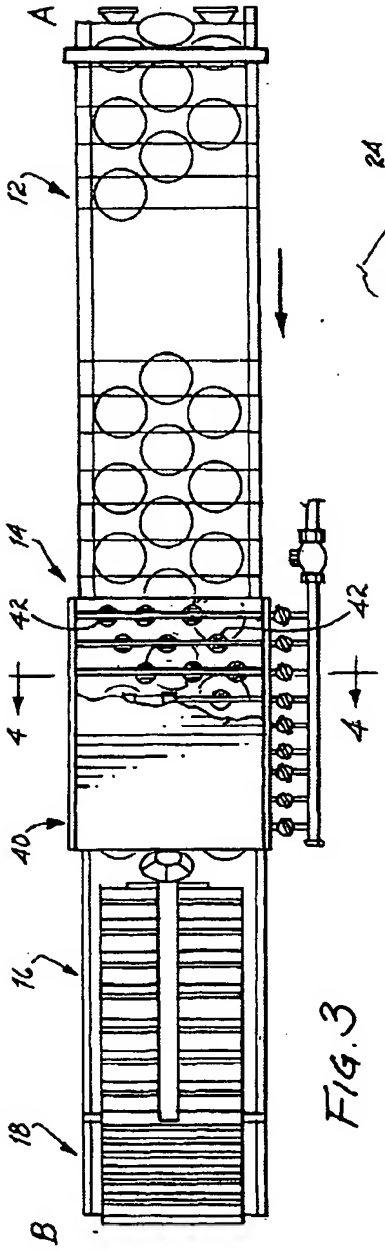


FIG. 3

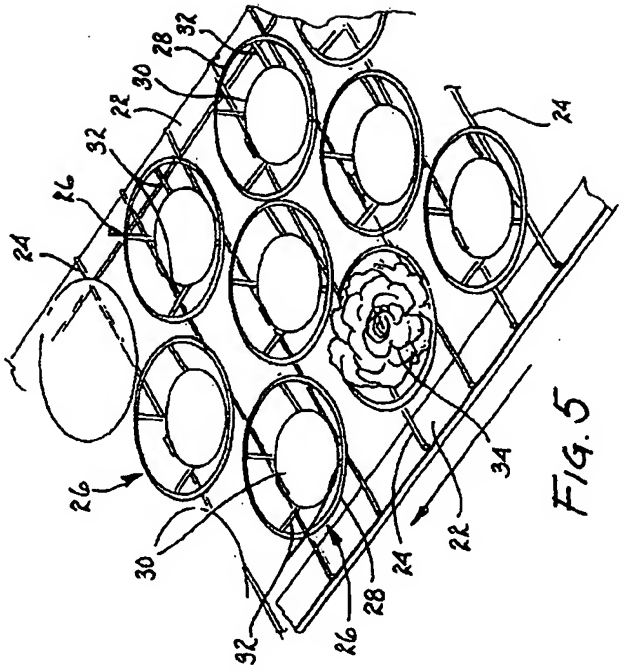


FIG. 5

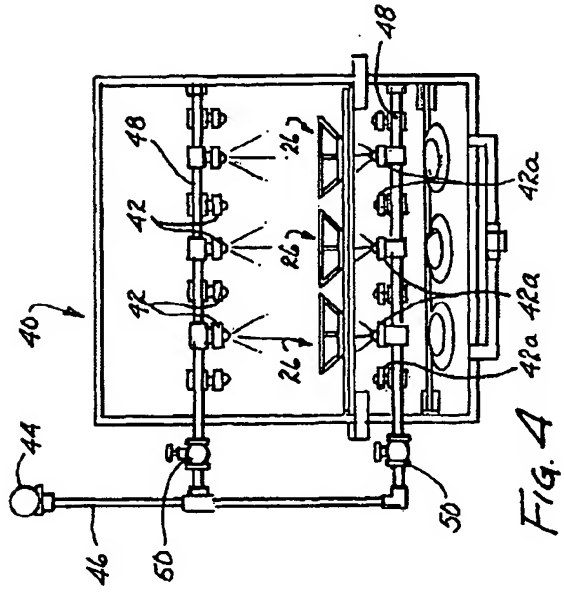


FIG. 4

PRODUCE WASHING METHOD

BACKGROUND OF THE INVENTION

1. Field of Invention

This invention relates generally to apparatuses and methods for cleaning produce in the field and, more specifically, to an apparatus and method for washing produce (including preferably lettuce) from the top and bottom and then loading the cleaned produce into a desired receptacle, such as a truck.

2. Background of the Invention

In the harvesting of lettuce, it is desirable to, as quickly and efficiently as possible, pick the lettuce, wash the lettuce, and position it for transport away from the field for further processing.

A number of different apparatuses have been developed over the years for cleaning harvested vegetables and fruits. Some of these, such as the "Produce Washer and Washing Method" disclosed in U.S. Pat. No. 5,820,694, are of a type not suited for use in the field where the vegetables and fruits are harvested. The use of such a washer is relatively inefficient, inasmuch as the washing of the produce cannot proceed as a step in the harvesting of the produce and its loading to a truck or other receptacle to be shipped away from the field for further processing.

U.S. Pat. No. 5,451,266 discloses a method for spray washing fruit in a brush bed. This method has the advantage that it washes produce in the field; however, it exposes the washed produce only to a spray coming from above the fruit. In order to provide a more complete wash, the method disclosed in U.S. Pat. No. 5,451,266 must provide rotating cylindrical brushes. This requirement increases the complexity of the apparatus, making it relatively expensive to manufacture and difficult to use.

There continues to be a need for an apparatus and method for effectively cleaning produce in the field. The apparatus and method should clean the produce from the top and the bottom without the need for brushes or like devices. The present invention satisfies these needs and provides other, related, advantages.

SUMMARY OF THE INVENTION

It is an object of the present invention to provide an apparatus and method for effectively cleaning produce, including particularly lettuce in the field.

It is a further object of the present invention to provide an apparatus and method for cleaning produce, including particularly lettuce, in a field setting both from the top and the bottom.

BRIEF DESCRIPTION OF THE PREFERRED EMBODIMENTS

In accordance with one embodiment of the present invention, a produce washing apparatus is disclosed. The apparatus comprises, in combination: a washing section having a washing unit disposed thereon so as to position spray nozzles both above and below the washing section; and a conveyor belt apparatus located on the washing section and adapted to transport produce through the washing unit from an entry point of the washing section to a terminating point of the washing section; wherein the conveyor belt apparatus further comprises produce receiving baskets adapted to receive the produce and to expose both a top portion and a bottom portion of the produce to spray emanating from each of the spray nozzles located above the washing section and the spray nozzles located below the washing section.

In accordance with another embodiment of the present invention, a produce washing apparatus is disclosed. The apparatus comprises, in combination: a washing section having a washing unit disposed thereon so as to position spray nozzles both above and below the washing section; a conveyor belt apparatus located on the washing section and adapted to transport produce through the washing unit from an entry point of the washing section to a terminating point of the washing section; wherein the conveyor belt apparatus located on the washing section further comprises produce receiving baskets adapted to receive the produce and to expose both a top portion and a bottom portion of the produce to spray emanating from each of the spray nozzles located above the washing section and the spray nozzles located below the washing section; a loading section pivotally coupled to the washing section at the entry point of the washing section; a conveyor belt apparatus located on the loading section and adapted to transport produce along the loading section from an entry point of the loading section to a terminating point of the loading section and from there to the* entry point of the washing section; an upward angled ascending section positioned at the terminating point of the washing section, after the washing unit; a conveyor belt apparatus located on the ascending section and adapted to transport produce along the ascending section from an entry point of the ascending section to a terminating point of the ascending section; wherein the conveyor belt apparatus located on the ascending section further comprises a plurality of steps located thereon and dimensioned to prevent the produce from falling backward as it travels upward along the ascending section; a downward angled dumping section positioned at the terminating point of the upward angled ascending section; a conveyor belt apparatus located on the dumping section and adapted to transport produce along the dumping section from the terminating point of the ascending section to a terminating point of the dumping section; and a trailer coupled to the produce washing apparatus.

In accordance with still another embodiment of the present invention, a method for washing produce is disclosed. The method comprises the steps of: providing a washing section having a washing unit disposed thereon so as to position spray nozzles both above and below the washing section; providing a conveyor belt apparatus located on the washing section and adapted to transport produce through the washing unit from an entry point of the washing section to a terminating point of the washing section; wherein the conveyor belt apparatus further comprises produce receiving baskets adapted to receive the produce and to expose both a top portion and a bottom portion of the produce to spray emanating from each of the spray nozzles located above the washing section and the spray nozzles located below the washing section; placing produce in the produce receiving baskets; passing the produce receiving baskets with the produce therein through the washing unit; exposing the top portion and the bottom portion of the produce to spray emanating from each of the spray nozzles located above the washing section and the spray nozzles located below the washing section.

The foregoing and other objects, features, and advantages of the invention will be apparent from the following, more particular, description of the preferred embodiments of the invention, as illustrated in the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a side view of the produce washing apparatus of the present invention.

FIG. 2 is a side view of the conveyor portion of the produce washing apparatus of FIG. 1.

FIG. 3 is a top, partially cut-away, view of the produce washing apparatus of FIG. 1.

FIG. 4 is an end view of the washing area portion of the produce washing apparatus of FIG. 1.

FIG. 5 is a perspective view of the produce basket portion of the produce washing apparatus of FIG. 1.

FIG. 6 is a side view of the produce basket portion of the produce washing apparatus of FIG. 1, illustrating the path followed by the produce baskets during operation.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring first to FIG. 1, the produce washing apparatus **10** ("apparatus **10**") of the present invention is shown. The apparatus **10** transports produce to be washed along a conveyor that proceeds from entry point A to exit point B. Referring also to FIG. 2, the apparatus **10** can be seen to preferably comprise four sections: a loading section **12**, a washing section **14**, an ascending section **16**, and a dumping section **18**. The entire apparatus **10** is preferably mounted on a trailer **20**, which may be coupled to a vehicle having an appropriate hitching device (not shown) so as to permit the apparatus **10** to be readily transported to and from the field and to different areas in a particular field.

The loading section **12** and washing section **14** preferably articulate with respect to one another, about point C. This articulation allows the loading section **12** to be positioned at a desired height for the loading of the produce thereon.

Attention is now directed to FIGS. **5** and **6**. Travelling the length of the loading section **12** and washing section **14** is a conveyor belt apparatus, consisting preferably of chain belts **22**, to which are attached and between which are positioned rods **24**. To the rods **24** are coupled produce baskets **26**, so that each basket **26** sits between and is coupled to two rods **24**. As shown in FIG. **5**, the baskets **26** are preferably positioned along the rods **24** so as to form alternating rows of one and two baskets **26**.

Each basket **26** preferably comprises an upper ring **28**, a base ring **30** having a smaller diameter than the upper ring **28**, and support members **32** projecting from the base ring **30** to the upper ring **28**. (There are preferably four, substantially equidistant support members **32** interposed between the upper ring **28** and base ring **30**.) The baskets **26** should be dimensioned to accommodate the produce with which the apparatus **10** is to be used. As shown in FIG. **5**, where the produce is lettuce **34**, the upper ring **28** should have a circumference larger than that of a typical head of lettuce **34**, while the base ring **30** should have a base ring **30** with a circumference smaller than that of a typical head of lettuce **34**. In this fashion, the lettuce **34** can be positioned within the basket **26** in a relatively secure manner, and, as discussed more fully below, water may pass through the baskets **26** so as to contact the lettuce **34**. (While the apparatus **10** is preferably used with lettuce **34**, it should be understood that it could be used with other vegetables and fruits that are harvested from a field and that would benefit from a washing step.)

Still referring to FIG. **5**, in the preferred embodiment, the upper ring **28** forms only a partial circle ending at two of the support members **32**, so that a front portion of the upper ring **28** is left open. This permits produce to be more readily dumped from the basket **26** at the end of the washing section **14**, and acts to prevent produce from becoming stuck in the basket **26** and potentially becoming damaged or interfering with the operation of the apparatus **10**.

As shown in FIGS. **2** and **6**, as the baskets **26** reach the end of the washing section **14**, they pass to the underside of the washing section **14** and continue past the underside of the loading section **12** to point A, at which position they return to an upward orientation along the top of loading section **12**.

As shown in FIGS. **1** and **2**, the ascending section **16** features steps **36**, which are dimensioned to receive the produce—such as heads of lettuce **34**—as they are emptied from the baskets **26** at the end of the washing section **14**. As shown in more detail in FIG. **2**, the steps **36** are preferably angled slightly upward, so as to prevent the produce from falling backward onto the washing section **14**. The steps **36** carry the produce upward toward the dumping section **18**, which preferably features a simple conveyor belt surface **38**. Because the dumping section **18** is angled in a downward direction from the apex of the ascending section **16**, there is no need for baskets or steps to maintain the produce in position as it is moved forward. At the terminus of the dumping section **18**, at exit point B, the produce is dumped into a receptacle **39**, which may be a truck bed or other suitable vessel.

Attention is now directed to FIGS. **1**, **3** and **4**. Along the washing section **14** is located a washing unit **40**. The washing unit **40** is disposed around a portion of the washing section **14**, and positions spray nozzles **42** directly above and spray nozzles **42***a* directly below the washing section **14**. Water is transported to the spray nozzles **42** and **42***a* via a main supply line **44**, which in turn feeds water down vertically oriented feeder lines **46**, from which the water is then routed to horizontally oriented feeder lines **48**, and from there to the spray nozzles **42** and **42***a*. (As shown in FIGS. **3** and **4**, the spray nozzles **42** and **42***a* are preferably staggered so as to provide more effective spray coverage.) Shut-off valves **50** are preferably positioned on the horizontally oriented feeder lines **48**, so that the flow of water to the spray nozzles **42** or **42***a* can be terminated, if desired.

Statement of Operation

The first step in using the apparatus **10** would be to position the apparatus **10** in the desired location—presumably in the field but also possibly in a non-field setting. This may be accomplished by coupling the trailer **20** upon which the apparatus **10** is mounted to a vehicle having an appropriate hitching device, and transporting the apparatus **10** to the desired location.

It will then be necessary to couple the apparatus **10**, and in particular the main supply line **44**, to a water source, so as to provide water to the washing unit **40**. (Assuming water is to be sprayed onto the produce from both above and below, each of the shut-off valves **50** will be turned to the on position.) It will further be necessary to couple the apparatus **10** to an appropriate power source (not shown), such as a portable generator, which power source will power the conveyors located on each of the loading section **12**, washing section **14**, ascending section **16**, and dumping section **18**. Before use of the apparatus **10** can begin, it is finally necessary to position each of the loading section **12**, ascending section **16**, and dumping section **18** at the desired angles for optimal convenience—and to place a receptacle **39** below the terminus of the dumping section **18**.

The next step will be to place individual pieces of produce into the baskets **26** at some point along the loading section **12**, or even along the washing section **14** before the washing unit **40**. If the produce is lettuce, it will be preferred to

remove the core of the lettuce head **34** prior to placing it in the baskets **26**, so as to provide for a more effective washing of the lettuce head **34**. As the produce enters the washing unit **40**, it will be exposed to a water spray both from above and below, via spray nozzles **42** and **42***a*. From the top, the spray will strike the top portion of the produce located in the baskets **26**. From the bottom, the spray will pass through the returning, inverted baskets located on the bottom of the washing section **14**, and will strike the bottom portion of the produce located in the baskets **26**.

Upon exiting the washing unit **40**, the produce will pass to the ascending section **16** and in particular to the steps **36** thereon, and will be raised to the dumping section **18**. The produce will then exit the steps **36** and pass onto the conveyor belt surface **38** on the dumping section **18**, and will be transported from there to be dumped into the receptacle **39** at point B.

While the invention has been particularly shown and described with reference to preferred embodiments thereof, it will be understood by those skilled in the art that the foregoing and other changes in form and details may be made therein without departing from the spirit and scope of the invention. For example, it may be possible to eliminate the loading section **12**, and in effect to combine the loading section **12** and washing section **14** into a single unit. It may further be possible to eliminate either or both of the ascending section **16** and dumping section **18**, so that washed produce is transported from the washing section **14** to the receptacle **39** or from the ascending section **16** to the receptacle **39**.

I claim:

1. A method for washing produce comprising the steps of:

providing a washing section having a washing unit disposed thereon so as to position spray nozzles both above and below said washing section;

providing a conveyor belt apparatus located on said washing section and adapted to transport produce through said washing unit from an entry point of said washing section to a terminating point of said washing section;

wherein said conveyor belt apparatus further comprises produce receiving baskets adapted to receive said produce and to expose both a top portion and a bottom portion of said produce to spray emanating from each of said spray nozzles located above said washing section and said spray nozzles located below said washing section;

wherein said produce receiving baskets comprises an upper ring that is dimensioned to receive a single item of said produce therein and that is open at an upper portion thereof to permit said single item of said produce to be placed therein, a base ring having a smaller diameter tan said upper ring and that is open at a lower portion thereof to expose said single item of said produce to said spray from said spray nozzles located below said washing section and support members projecting from said base ring to said upper ring;

harvesting produce from a field;

placing said produce in said produce receiving baskets;

passing said produce receiving baskets with said produce therein though said washing unit; and

exposing said top portion and said bottom portion of said produce to spray emanating from each of said spray nozzles located above said washing section and said spray nozzles located below said washing section;

wherein said produce is lettuce.

2. The method of claim **1** further comprising the steps of:

providing a loading section pivotally coupled to said washing section at said entry point of said washing section;

providing a conveyor belt apparatus located on said loading section and adapted to transport produce along said loading section from an entry point of said loading section to a terminating point of said loading section and from there to said entry point of said washing section;

loading said produce on said conveyor belt apparatus on said loading section; and

transporting said produce along said loading section to said washing section.

3. The method of claim **1** further comprising the steps of:

providing an upward angled ascending section positioned at said terminating point of said washing section, after said washing unit;

providing a conveyor belt apparatus located on said ascending section and adapted to transport produce along said ascending section from an entry point of said ascending section to a terminating point of said ascending section; and

transporting said produce upward along said ascending section.

4. The method of claim **3** wherein said conveyor belt apparatus located on said ascending section further comprises a plurality of steps located thereon and dimensioned to prevent said produce from falling backward as it travels upward along said ascending section.

5. The method of claim **3** further comprising the steps of:

providing a downward angled dumping section positioned at said terminating point of said upward angled ascending section;

providing a conveyor belt apparatus located on said dumping section and adapted to transport produce along said dumping section from said terminating point of said ascending section to a terminating point of said dumping section;

transporting said produce along said dumping section to a terminating point of said dumping section; and

dumping said produce from said terminating point of said dumping section into a receptacle.

6. The method of claim **1** further comprising the step of providing a trailer coupled to said washing section.

* * * * *